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'Permutation, Pattern, and Process'

A commentary on my recent compositional work

Sean Torr

A thesis submitted to the University of Huddersfield in partial fulfilment of the requirements for the
degree of Master of Arts by Research

The University of Huddersfield

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list of portfolio contents

<i>solo organ ascending</i>	[for solo organ, c. 20 minutes, 2015-2018]
<i>solo organ descending</i>	[for solo organ, c. 20 minutes, 2015-2018]
<i>solo viola ascending (i)</i>	[for solo viola, c. 3 minutes, 2016-2017]
<i>solo viola ascending (ii)</i>	[for solo viola, c. 3 minutes, 2016-2017]
<i>solo viola ascending (iii)</i>	[for solo viola, c. 3 minutes, 2016-2017]
<i>solo viola ascending (iv)</i>	[for solo viola, c. 3 minutes, 2016-2017]
<i>solo viola ascending (v)</i>	[for solo viola, c. 3 minutes, 2016-2017]
<i>solo viola ascending (vi)</i>	[for solo viola, c. 3 minutes, 2016-2017]
<i>solo viola ascending (vii)</i>	[for solo viola, c. 3 minutes, 2016-2017]
<i>solo viola ascending (viii)</i>	[for solo viola, c. 3 minutes, 2016-2017]
<i>solo viola ascending (ix)</i>	[for solo viola, c. 3 minutes, 2016-2017]
<i>solo viola ascending (x)</i>	[for solo viola, c. 3 minutes, 2016-2017]
<i>solo viola ascending (xi)</i>	[for solo viola, c. 3 minutes, 2016-2017]
<i>solo viola ascending (xii)</i>	[for solo viola, c. 3 minutes, 2016-2017]
<i>solo viola descending (i)</i>	[for solo viola, c. 3 minutes, 2016-2017]
<i>solo viola descending (ii)</i>	[for solo viola, c. 3 minutes, 2016-2017]
<i>solo viola descending (iii)</i>	[for solo viola, c. 3 minutes, 2016-2017]
<i>solo viola descending (iv)</i>	[for solo viola, c. 3 minutes, 2016-2017]
<i>solo viola descending (v)</i>	[for solo viola, c. 3 minutes, 2016-2017]
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<i>solo viola descending (ix)</i>	[for solo viola, c. 3 minutes, 2016-2017]
<i>solo viola descending (x)</i>	[for solo viola, c. 3 minutes, 2016-2017]
<i>solo viola descending (xi)</i>	[for solo viola, c. 3 minutes, 2016-2017]
<i>solo viola descending (xii)</i>	[for solo viola, c. 3 minutes, 2016-2017]
<i>solo harp ascending</i>	[for solo viola, c. 3 minutes, 2016-2017]
<i>solo harp descending</i>	[for solo viola, c. 3 minutes, 2016-2017]
<i>four saxophones ascending (i)</i>	[for four saxophones, open duration, 2016-2017]
<i>four saxophones descending (i)</i>	[for four saxophones, open duration, 2016-2017]
<i>ten clarinets ascending (i)</i>	[for two identical clarinet quintets, c. 12 minutes, 2016-2017]
<i>ten clarinets ascending (ii)</i>	[for two identical clarinet quintets, c. 12 minutes, 2016-2017]
<i>ten clarinets ascending (iii)</i>	[for two identical clarinet quintets, c. 12 minutes, 2016-2017]
<i>ten clarinets ascending (iv)</i>	[for two identical clarinet quintets, c. 12 minutes, 2016-2017]
<i>ten clarinets descending (i)</i>	[for two identical clarinet quintets, c. 12 minutes, 2016-2017]
<i>ten clarinets descending (ii)</i>	[for two identical clarinet quintets, c.12 minutes, 2016-2017]
<i>ten clarinets descending (iii)</i>	[for two identical clarinet quintets, c.12 minutes, 2016-2017]
<i>ten clarinets descending (iv)</i>	[for two identical clarinet quintets, c. 12 minutes, 2016-2017]
<i>sixteen lines ascending</i>	[open instrumentation, open duration, 2017]
<i>sixteen lines descending</i>	[open instrumentation, open duration, 2017]

introduction(s)

The following portfolio is comprised of forty original compositions. The portfolio is presented across six series, that each form a distinct set of closely related, yet ultimately stand-alone works: the *solo organ* series; the *solo viola* series, the *solo harp* series, the *four saxophones* series, the *ten clarinets* series, and the *sixteen lines* series. Each series is sub-divided further and is presented in two halves that each form a distinct sub-set of closely related, yet ultimately stand-alone works. Each series is divided into an *ascending* sub-set of pieces, and a *descending* sub-set of pieces.

In any given series, each sub-set of pieces is intended to function as the counterpart to the other. The two sub-sets in each series are conceived so that the pieces contained within one sub-set directly correspond to the pieces contained within the other. Essentially, the sub-sets within any given series can be considered a mirror image of one another. The titles of each work are generated according to this concept. For instance, *solo viola ascending (i)*, corresponds to *solo viola descending (i)*; and likewise, *ten clarinets ascending (ii)*, corresponds to *ten clarinets descending (ii)*.

Fundamentally, the title of any given piece within this portfolio serves to classify and catalogue the given piece within my compositional output. Each title is arranged hierarchically and specifies up to three elements of classification in succession, from the most general classification to the most specific classification. Every title indicates: (a) the series from which the piece derives, and (b) the sub-set from which the piece derives. In instances where a sub-set is comprised of a number of pieces greater than one, the given pieces are assigned a bracketed roman numeral as a third element of classification.

Each piece presented in this portfolio may be performed alone, or together in combination with any number of other pieces from the same series. In such a case, the performance of each piece should ideally be interspersed with other programmed works. Performers may choose to perform a selection of pieces taken from an individual sub-set, or otherwise.

The portfolio of original compositions represents the culmination of approximately four years of compositional practice and study undertaken at the University of Huddersfield, during both my undergraduate and post-graduate studies. In that time, my compositional work has been preoccupied with two strands of thought: musical minimalism; and music and/as process. This portfolio is the physical manifestation of both the consolidation and exploration of these two strands of thought.

In short, my recent compositional work has explored how my music might be considered as minimal, or minimalist. In pursuit of this aim, this thesis examines two key aspects of my music: (a) the construction of my music, and (b) the presentation of my music, i.e. how my music is produced as an artefact (score). Furthermore, my recent compositional output has explored how process might be used as a compositional device engaged with a possible minimalist aesthetic concern. This thesis presents some thoughts on a possible relationship between music and/as process, and music and/as minimalism.

By drawing on examples from composers, visual artists, and scholars, I shall attempt to discern how my own compositional work engages with a number of key concepts, and aesthetic concerns that I consider to be allied with minimalism.

In *Minimalists*, by K. Robert Schwarz, minimal music is summarised as follows: ‘minimalist music is based on the notion of reduction, the paring down to a minimum of the materials that a composer will use in a given work. In the classic minimalist compositions of the 1960s, practically every musical element – harmony, rhythm, dynamics, instrumentation – remains fixed for the duration of the work, or changes only very slowly’ (1996, p.9). Meanwhile, in *Minimalism: Origins*, Edward Strickland gives perhaps the simplest definition of minimalism as follows: ‘minimalism is a style distinguished by severity of means, clarity of form, and simplicity of structure and texture’ (1993, p.4).

On the 30th March of 1972, Tom Johnson wrote an article in the *Village voice* entitled *The Minimal Slow-Motion Approach*. It is highly likely that the significance of this article may not have been known at the time, but, as Johnson himself later explained, his article of 30th March 1972 is ‘generally considered the first time that any music critic spoke of minimal music’ (Johnson, 2018). Within *The Minimal Slow-Motion Approach*, Johnson discusses three pieces by three artists¹, that were presented at a ‘now historic’ concert at the Village Presbyterian Church in Greenwich Village. More significantly, the article approaches a definition of the essence of minimal music: as a music containing a ‘very small range of contrast’ (1989, p.23). For me, a reduced range of contrast constitutes a significant thread to what I consider musical minimalism.

Morton Feldman explained his interest in music of small contrasts as follows: ‘I am interested in music where the variation is so discreet, I would have the same thing come back again, but I would just add one note. Or I have to come back and I take out two notes. And I would vary the notes and keep the pulse, very subtle... In other words, I’m not creating music, it’s already there, and I have this conversation with the material, you see’ (Feldman, 2008).

In striving to emulate these aspects, and thereby create an iteration of a possible minimal music, I have developed an approach to musical composition that uses permutation as a generative and forming device. In other words, I have developed a number of different ways to use permutation as a device to generate material, and to govern the organisation of the material into a discernible structure. In developing my use of permutation as a compositional device, I have been able to achieve the maximum exhaustion of any given material, and ensure any given work contains a limited range of contrast.

In my understanding of minimal music, the use of process and minimalism are intrinsically linked. I consider the application of process, such as the deployment of permuting automata, a crucial element to the inherent materiality of minimal music. This is another key aspect of minimalism: its ‘reduction to, and identification with its rudiments’ (Strickland, 1993, p.14).

¹*Sagging and Reading Room* by Stuart Marshall, *Journal of Private Lives* by Mary Lucier, and *The Queen of the South* by Alvin Lucier (Johnson, 1989, p.23).

Minimal music is often identified as 'nothing other than its constitutive unaltered materials and explicit mode of construction' (Gough, 2001, p.98). Minimal music is, therefore, essentially non-representational. Minimal music is literally, literal: the perception of any given work is formed entirely within its own reality. Frank Stella expressed this literalist sensibility succinctly, in a now famous pronouncement: 'What you see is what you see' (Gough, 2007, p.98).

For this reason, much minimal music can be considered as a form of conceptual art. In *Paragraphs on Conceptual Art*, Sol LeWitt summarised conceptual art as follows: 'in conceptual art, the idea or concept is the most important aspect of the work (1967, p.79). LeWitt goes on to explain that in the process, i.e. that act of creating conceptual art, 'the planning and decisions are made beforehand and the execution is a perfunctory affair' (1967, p.79). In much minimal music, the concept is the element that governs works construction, the generation and application (formalization) of its rudimentary materials.

Within my recent compositional work, I have been particularly inspired by the work of Tom Johnson. In particular, Johnson's work has influenced my approach to the creation of conceptual process-led minimal music. In short, my recent compositional output has followed two approaches to the invention and application of process in process-led minimal music: (a) the use of borrowed material, and the recontextualisation of said material via the application of process, and (b) the formation of pared-back material into logical, often rule-based forms.

These concepts can find their genesis within work by Johnson. For instance, in *Narayana's Cow's* (1989), Johnson considers a mathematical problem attributed to an Indian mathematician of the 14th century, Narayana. The problem reads as follows: 'A cow produces one calf every year. Beginning in its fourth year, each calf produces one calf at the beginning of each year. How many cows and calves are there altogether after 20 years?' (Kalvos & Damian, 2015). Johnson found that the solution to this mathematical problem formed a unique numerical sequence. This sequence was then translated into music: the variation of duration and interval size, was used to represent the varying population of cows and calves. In essence, *Narayana's Cow's*, presents the solution to this mathematical problem musically. On the other hand, Johnson's piece does not provide the complete solution to the problem, the music concludes at the 17th year by which point 'there are already 8,772 cows and calves, and 15 minutes of music' (Kalvos & Damian, 2015).

In my understanding of the piece, Johnson's *Narayana's Cow's* uses a combination of the two approaches aforementioned. The work is fundamentally conceptual, being the musical demonstration of a mathematical problem. The work also makes use of borrowed material, i.e. the mathematical problem attributed to Narayana. Furthermore, the work uses a logical, rule-based process to determine the musical translation of the problems working-out.

My recent compositional work has also been concerned with aligning the presentation of the music, i.e. the visual aspects of the score, with the aesthetic principals that provide the impetus behind the creation of the music itself. In many regards, this aspect of my creative practice considers the music score to be an art form, i.e. literal artistic artefact, in and of itself. In short,

my approach to the presentation of each score is guided by the following key principals: (a) to communicate what is entirely essential, and no more; (b) to be clear and concise in communication; and (c) to show, rather than tell².

Each of the following six chapters will discuss a single series of works from the portfolio of composition presented in this submission. The chapters are intended to focus on the inherent materiality of each series. As such, each chapter will identify the rudimentary material contained within any given series, and define how the material was generated, and how the material has been formalized within each work within the given series. Furthermore, in instances where a series of works are explicitly conceptual, the corresponding chapter will outline the theory and application of the given concept. In the same manner, in instances where a series of work explicitly borrows material from another source, the corresponding chapter will outline the process used in the recontextualisation of the borrowed material. In general, each chapter aims to illuminate the 'severity of means, clarity or form, and simplicity of structure and texture' of each given work. By doing so, I intend to aid the understanding and appreciation of the music presented within the portfolio, and also go some way to demonstrating how this music may be considered as minimal, or minimalist.

² This concept is specifically inspired by Morag Grant, who argues that 'experimental music doesn't tell us something, it shows us something' (Grant, 2003, p.183).

chapter one: the solo organ series

The *solo organ* series is comprised of two original compositions. The series is presented in two halves that each form a subset of a single, stand-alone piece: *solo organ ascending*, and *solo organ descending*. Each piece may be performed alone, or together within a single programme. In such a case, the performance of each piece should ideally be interspersed with other programmed works. The pieces within the series are identically scored. As their titles suggest, each piece is written for solo organ. The pieces can be performed on up to two manuals, but the pedals should not be used during the performance of either piece. Likewise, there should be no changes in registration throughout each piece. The *solo organ* series is dedicated with compliments to William Henry Monk (1823-1889).

Each score is formed of four-part polyphonic writing: each piece consists of four individual parts or lines, i.e. [Bass-Tenor-Alto-Soprano], that move independently of one another. Throughout the entire *solo organ* series, there is not a single action in any given line or part, that is simultaneous with an action of another line or part.

Both pieces within the *solo organ* series begin monophonically, with a single note, three additional lines are then introduced in succession, which creates a four-part texture. The four-part texture is largely maintained throughout the entirety of each piece. This process is carried out in reverse at the conclusion of both pieces: individual lines are removed in succession until only a single note remains.

Essentially, each piece consists of a series of one hundred and twenty-seven verticalities that are comprised of between one and four pitches. Each consecutive verticality is distinct from one another by a single harmonic (pitch) or textural variation alone. Specifically, each verticality provides either the addition, subtraction, or alteration of a single pitch; and therefore, has the potential to alter the number of parts sounding at any given moment (i.e. texture). In other words, each verticality will either: (a) introduce a new pitch in a new part, and thus increase the number of parts sounding by one (to a maximum of four parts); or (b) remove a single pitch, and thus decrease the number of parts sounding by one (to a minimum of one part); or (c) alter a single pitch in a part already sounding, and thus have no impact on the number of sounding parts.

In this regard, the *solo organ* series shares a number of similarities with *Harmonies*, a piece composed by György Ligeti in 1967³. Both works are scored for organ, although, Ligeti does explain that ‘since the organist uses both hands at all times, an assistant will be needed to change the registration’ (1969, p.4). The most significant similarity, however, is that both works are comprised of a series of consecutive verticalities, or chords, that are distinct from one another by a single harmonic or

³ *Harmonies* was not published until 1969 in *Two Etudes for Organ*.

textural variation. As in the *solo organ* series, the consecutive verticalities or chords within *Harmonies*, are distinct from one another through the alteration, addition, or removal of a single pitch alone⁴.

Given the similarities aforementioned, the approach to notation used within the *solo organ* series was specifically modelled on the approach to notation used by Ligeti in *Harmonies*. Moreover, with the exception of omitting bar lines, the *solo organ* series adapts entirely the same approach to notation that Ligeti uses within *Harmonies*. Both works use a combination of two stemless note heads: open (white) and closed (black) note heads. To be specific, in any given verticality or chord, the open (white) note heads indicate a pitch that has been altered or added; whereas the closed (black) note heads are used to indicate any pitches that remain unchanged, i.e. pitches that are held from the previous chord.

The use of two distinct note head styles should not be interpreted as an indication of any durational ratios or values. As Ligeti explains, the only purpose of the varied note heads is to make the score easier to read (1969, p.4). In essence, in both works, each score specifies every individual sound and action⁵, and their succession. As such, in both the *solo organ* series and *Harmonies*, the performer is responsible for determining the exact duration of every sound and action within the given framework.

In *Harmonies*, Ligeti advises that 'individual bars can differ in length as the player wishes' (1969, p.4). Similarly, each score of the *solo organ* series advises that the duration of every individual sound and action is 'free', and is thereby left to the discretion of the performer. Ideally, the performer of the *solo organ* series should determine the duration of all individual sounds and actions in the very moment of performance, and not in advance. Owing to the indeterminate duration of individual sounds and actions, the total duration of each performance can vary. In both works, the actions of the performer determine the total duration of each performance.

The pitch material within the *solo organ* series is derived from the hymn tune *Eventide*, which was composed by the organist William Henry Monk in 1861⁶. Essentially, the *solo organ* series is comprised of two original compositions that each present a distinct recontextualisation of this source material, i.e. William Henry Monk's *Eventide*.

⁴ Notwithstanding the alterations made to the registration by the assistant in *Harmonies* (aforementioned).

⁵ The addition, subtraction, or alteration of a single pitch.

⁶ *Eventide*, is perhaps best known as the 'accompanying tune' for the hymn text *Abide with Me*, which was written in 1820 by Rev. Henry Francis Lyte (1793-1847). Monk specifically composed *Eventide* as the musical accompaniment to *Abide with Me*, and included it in the 1861 edition of Hymns, Ancient and Modern, for which he served as editor (Rainbow, 2017).

The construction of both pieces began by extrapolating the pitch material from *Eventide*⁷. The source material was reproduced in its entirety, apart from the original durational ratios or values, which were removed. This process created a progression of forty-four chords that presented each distinct consecutive verticality or chord, that (a) could be found within the source material, and (b) that was distinct from one another by a single harmonic (pitch) or textural variation alone. For clarification, *figure one* and *figure two* outline this process.

figure one



figure one: William Henry Monk's *Eventide* (1990).

⁷ Note: In the construction of the *solo organ* series, the pitch material was extrapolated from the version of *Eventide* published in the 1990, Organ Edition of Hymns, Ancient and Modern (New Standard).

figure two

The musical score consists of four systems, each with four measures. The key signature is one flat (F major/D minor). The chords are as follows:

- System 1: i, ii, iii, iv, v, vi, vii, viii, ix, x
- System 2: xi, xii, xiii, xiv, xv, xvi, xvii, xviii, xix, xx
- System 3: xxi, xxii, xxiii, xxiv, xxv, xxvi, xxvii, xxviii, xxix, xxx, xxxi, xxxii, xxxiii
- System 4: xxxiv, xxxv, xxxvi, xxxvii, xxxviii, xxxix, xl, xli, xlii, xliiii, xliv

figure two: The progression of forty-four chords (i-xlv) derived from William Henry Monk's *Eventide*.

This sequence of forty-four chords forms the foundation of both pieces within the *solo organ* series. In each piece, the chord progression is preserved, but the component notes of each chord are sounded in succession, rather than as a simultaneous chord. Throughout each piece, and in any given verticality, each component note is held, whilst the remaining notes are sounded, and until the next verticality is reached. The pitch material transitions from any given verticality to the next, by specifying each necessary action (i.e. the addition, alteration, or removal of a single pitch) one at a time, in succession. This manipulation essentially forms an augmented version of the original chord progression, that is played one note at a time.

In the construction of the *solo organ* series, the total number of individual actions required to transition from each given verticality or chord, to the next was identified. In instances where the total number of actions required to transition from any given verticality to the next was greater than one, the succession of the individual actions was altered. In these cases, the order in which the individual actions occurred was governed by one of the following series of permutations: (a) a series comprised of the permutations of a two-member set, i.e. [1-2]; (b) a series comprised of the permutations of a three-member set, i.e. [1-2-3]; and (c) a series comprised of the permutations of a four-member set, i.e. [1-2-3-4]. The total number of individual actions required to transition from each given verticality or chord, to the next, determined which series of permutations was used to specify the order in which each given action occurred. To clarify: (a) if two actions were required to transition from a given verticality to the next, then the succession of individual actions was governed by the permutations of a two-member set; (b) if three actions were required to transition from a given verticality to the next, then the succession of individual actions was governed by the permutations of a three-member set; (c) if four actions were required to transition from a given verticality to the next, then the succession of individual actions was governed by the permutations of a three-member set.

Each permutation specified the succession of individual actions within a single transition from a given verticality or chord, to the next. In any given permutation, each component, i.e. number, is read as the numerical substitution of an individual active part (the part or line in which an individual action occurs, i.e. [Bass-Tenor-Alto-Soprano]). Each numerical substitution was generated according to (a) the total number of active parts in the given transition, and (b) the standard registral placement of the given active parts. In any given transition, the lowest active part was assigned the lowest numerical substitution, i.e. [1], and the remaining active parts were assigned a numerical substitution in succession from the lowest active part, to the highest active part. This process assumed the 'standard' registral placement of the given active parts, from the lowest active part, to the highest active part, i.e. [Bass-Tenor-Alto-Soprano]. For clarification, *table one* details the numerical substitution for every possible combination of active parts. Each permutation was read from left to right, and thus specified the order in which every individual action occurs within any given transition from one verticality to the next.

table one

<i>no. active part(s)</i>	<i>part(s) active</i>				<i>numerical substitution</i>			
1	B				1			
1		T				1		
1			A				1	
1				S				1
2	B	T			1	2		
2	B		A		1		2	
2	B			S	1			2
2		T	A			1	2	
2		T		S		1		2
2			A	S			1	2
3	B	T	A		1	2	3	
3	B	T		S	1	2		3
3	B		A	S	1		2	3
3		T	A	S		1	2	3
4	B	T	A	S	1	2	3	4

table one: The numerical substitutions for every possible combination of active parts in the *solo organ* series.

In the construction of the *solo organ* series, each permutation was selected such that each successive permutation from the same *n*-membered set would form a dissected sequence. In essence, both pieces within the *solo organ* series were formed from three independently arranged, but interlocked sequences of permutations. Throughout each piece within the *solo organ* series, each of the three interlocked sequences loop independently of one another, in continuous cycle.

In *solo organ ascending*, each permutation was selected so that each of the three interlocked sequences were arranged to form an ascending sequence of permutations. As such, the sequence comprised of the permutations of a two-member set were arranged from [1-2] to [2-1], the sequence comprised of the permutations of a three-member set were arranged from [1-2-3] to [3-2-1], and the sequence comprised of the permutations of a four-member set were arranged from [1-2-3-4] to [4-3-2-1]. To clarify, the structure of *solo organ ascending* is outlined in *appendix one*.

In *solo organ descending*, each permutation was selected so that each of the three interlocked sequences were arranged to form a descending sequence of permutations. As such, the sequence comprised of the permutations of a two-member set were arranged from [2-1] to [1-2], the sequence comprised of the permutations of a three-member set were arranged from [3-2-1] to [1-2-3], and the sequence comprised of the permutations of a four-member set were arranged from [4-3-2-1] to [1-2-3-4]. To clarify, the structure of *solo organ descending* is outlined in *appendix two*.

chapter two: the solo viola series

The *solo viola* series was written for Garth Knox, and is comprised of twenty-four original compositions. The series is presented in two halves that each form a sub-set of twelve individual, stand-alone pieces: *solo viola ascending (i-xii)*, and *solo viola descending (i-xii)*. The *solo viola* series can be considered as a collection of twenty-four miniatures. Each miniature may be performed alone, or together in combination with any number of other miniatures from the series⁸. In such a case, the performance of each miniature should ideally be interspersed with other programmed works. Each miniature within the series is identically scored. As their titles suggest, each miniature has been written for solo viola.

Each miniature within the *solo viola* series is notated graphically. The scores are presented across three, three-lined staves, that are read simultaneously from left to right, and page by page. Each staff contains a single colour-coded line that indicates the action, or movement, of a single musical parameter.

The *solo viola* series is constructed using three stratified musical parameters: bow position⁹, dynamic¹⁰, and stopped pitch. Each parametric strand is notated separately, on an individual three-lined staff. To clarify: bow position is notated graphically in black, on the upper-most three-line staff as follows: top line, *sul ponticello*; middle-line, *ordinario*; lowest line, *sul tasto*. Dynamic is notated graphically in red, on the middle three-line staff as follows: top line, *piano (p)*; middle-line, *pianissimo (pp)*; lowest line, *pianississimo (ppp)*. Stopped pitch is indicated graphically in green, on the lowermost three-line staff as follows: top-line, *(i)* any low note *sul C*; middle-line, *(ii)* a quartertone lower than *(i)*; lowest-line, *(iii)* a quartertone lower than *(ii)* or a semitone lower than *(i)*.

In performance, each parametric strand is in continuous motion between three discrete landmarks. In any given parametric strand, each line of the corresponding three-line staff represents a single landmark¹¹. As such, the points at which each colour-coded line intersects a staff line, represent every individual point of arrival or departure at any given landmark.

⁸ Performers may choose to perform a selection of miniatures from each sub-set individually, or otherwise.

⁹ Bow direction is not specified at any point during any piece, and can be altered freely at the discretion of the performer.

¹⁰ In this context, 'dynamic' is understood as the resultant combination of bow pressure and speed.

¹¹ For clarification: bow position moves between *sul ponticello*, *ordinario*, and *sul tasto*. Dynamic moves between: *piano (p)*, *pianissimo (pp)*, and *pianississimo (ppp)*. Stopped pitch moves between: *(i)* any low note *sul C*, *(ii)* a quartertone lower than *(i)*; and *(iii)* a quartertone lower than *(ii)* or a semitone lower than *(i)*.

In the construction of the *solo viola* series, each parametric strand is treated as a distinct quasi-polyphonic voice. Each parametric strand is formed from two sub-strata of information. The first sub-stratum determines the selection and succession of individual events, i.e. the individual points of arrival or departure at each landmark, and the order in which they occur. The second sub-stratum determines the placements of individual events in time, i.e. the moment at which each point of arrival or departure occurs, essentially determining the time taken to move from one landmark to another. At any point during each piece, the simultaneous execution of each parametric strand determines the sonic result. In essence, the stratified parametric strands are 're-coupled' in the moment of performance (Sergeant, 2003, p.5).

Within the first sub-stratum of each parametric strand, the selection and succession of individual points of arrival or departure, is determined by a sequence comprised of the permutations of a three-member set. In any given permutation, each component, i.e. number, is read as the numerical substitution of an individual landmark¹² in each parametric strand as follows:

- i. Bow position: *sul ponticello*, [3]; *ordinario*, [2]; *sul tasto*, [1].
- ii. Dynamics: *piano* (*p*), [3]; *pianissimo* (*pp*), [2]; *pianississimo* (*ppp*), [1].
- iii. Stopped pitch: any low note *sul C*, [3]; a quartertone lower than [3], [2]; a quartertone lower than [2], or a semitone lower than [3], [1].

There are six distinct permutations of a three-member set. In constructing the *solo viola* series, each permutation was assigned an individual roman numeral substitution as follows: [1-2-3], [i]; [1-3-2], [ii]; [2-1-3], [iii]; [2-3-1], [iv]; [3-1-2], [v]; and [3-2-1], [vi].

In every miniature, each parametric strand uses a unique sequence comprised of the permutations of a three-member set to determine the selection and succession of individual points of arrival or departure. Each sequence is comprised of all six distinct permutations of a three-member set. Any given permutation is used once, and only once within each sequence. To ensure every parametric strand is in continuous motion, each sequence of permutations is constructed so that no adjacent components are the same. The result of this restriction is that any given permutation can only be followed by one of three others, as the following six rules outline:

¹² Thereby representing a discrete point of arrival or departure at that landmark.

- i. Permutation [i] can only be followed by permutation [ii]; [iii]; or [iv].
- ii. Permutation [ii] can only be followed by permutation [i]; [v]; or [vi].
- iii. Permutation [iii] can only be followed by permutation [i]; [ii]; or [iv].
- iv. Permutation [iv] can only be followed by permutation [iii]; [v]; or [vi].
- v. Permutation [v] can only be followed by permutation [i]; [ii]; or [vi].
- vi. Permutation [vi] can only be followed by permutation [iii]; [iv]; or [v].

There are seventy-two sequences that conform to these rules. These sequences are listed in *appendix three*.

Within each parametric strand, the placement of individual events, i.e. each point of arrival or departure, in time forms the second sub-stratum of information. Throughout the *solo viola* series, the placement of individual 'events' is conceived within a proportional framework. The framework is conceived in units of one, two, and three. To aid the performer in their navigation of the piece, each score includes an unbound, transparent page that features vertical lines which delineate a single unit within the framework. Nevertheless, the duration of a single unit is not specified within the score, and is left to the discretion of the performer.

Within each parametric strand, the placement of individual events in time is determined by a sequence comprised of the permutations of a three-member set. In any given permutation, each component, i.e. number, is read as the numerical substitution of an individual unit as follows: one unit, [1]; two units, [2]; three units, [3]. Each permutation, therefore, is comprised of six units in total. As in the first sub-stratum of each parametric strand, each permutation was assigned an individual roman numeral substitution as follows: [1-2-3], [i]; [1-3-2], [ii]; [2-1-3], [iii]; [2-3-1], [iv]; [3-1-2], [v]; and [3-2-1], [vi].

In every miniature, each parametric strand uses a unique sequence comprised of the permutations of a three-member set to determine the placement of individual points of arrival or departure in time. Each sequence is comprised of six distinct permutations of a three-member set. Any given permutation is used once, and only once, within each sequence. The second sub-stratum of each parametric strand uses the same set of seventy-two sequences that are used to form the first sub-stratum of each parametric strand.

Within each miniature, the points of arrival or departure in every parametric strand are (only) aligned at the junction of adjacent permutations, and at the beginning and end of the piece. In any given score, each moment of alignment occurs at

the beginning and end of a system. Each system is notated on a single page, and is used to delineate a single component permutation in each sequence.

In any given piece, each sub-stratum is formed using a single sequence comprised of the permutations of a three-member set. As such, each piece within the *solo viola* series is constructed using a total of six sequences, that are used simultaneously in each of the six sub-strata. In any given piece, the six sequences are arranged so that no two component permutations are used simultaneously within any of the six sub-strata. Essentially, each piece within the *solo viola* series can be described as a distinct Latin Square¹³ formed from six components, in which each component is a distinct permutation of a three-member set.

Each sub-set of twelve piece uses all seventy-two sequences (aforementioned) once and only once, and is comprised of twelve distinct Latin Square arrangements. In the construction of the ascending sub-set of twelve pieces, i.e. *solo viola ascending (i-xii)*, the seventy-two sequences were arranged in ascending order, according to the first, second, third, fourth, and fifth component of each sequence in turn. Each Latin Square arrangement was then generated by listing the ‘smallest’ sequence possible at any given point. For clarification, the Latin Square arrangements used within *solo viola ascending (i-xii)* are detailed in *appendix four*.

In the construction of the descending sub-set of twelve piece, i.e. *solo viola descending (i-xii)*, the seventy-two sequences were arranged in descending order, according to the first, second, third, fourth, and fifth component of each sequence in turn. Each Latin Square arrangement was then generated by listing the ‘largest’ sequence possible at any given point. For clarification, the Latin Square arrangements used within *solo viola descending (i-xii)* are detailed in *appendix five*.

Each sub-set of twelve pieces contains twelve distinct Latin Square arrangements. Two interesting observations can be made about each sub-set of Latin Square arrangements. In each sub-set, each Latin Square arrangement is formed from six identical verticalities, i.e. six distinct arrangements of simultaneous components (permutations). As such, each Latin Square arrangement can be described as a unique permutation of the six distinct verticalities. Furthermore, each sub-set of Latin Square arrangements are inversely related to the other. The set of ascending Latin Square arrangements are an exact mirror image of the set of descending Latin Square arrangements, and vice versa.

Whilst there was no particular source of inspiration for the *solo viola* series, it was first conceived as a compositional study that attempted to move away from an engagement with specified pitch material, and the harmonic relationships established

¹³ A Latin Square is an arrangement of letters or symbols that each occur n times, in a square array of n^2 compartments so that no letter or symbol appears twice in the same row or column (Stevenson, 2010).

thereof. In the first instance, it may appear that the series successfully achieved this aim. Indeed, the sonic realisation of each miniature presents what is essentially a 'coloured' glissandi drone. As such, it could be argued that the *solo viola* series represents the furthest move away from pitch centrality that has been exhibited by my music. On the other hand, the construction of the *solo viola* series was still conceived with particular harmonic traits retained. The construction of each parametric strand, for instance, is treated as a distinct quasi-polyphonic voice. Indeed, each parametric strand could easily be adapted into a melodic line by reconsidering each discrete 'landmark' as an individual pitch or interval.

Meanwhile, the *solo viola* series also represents a compositional study in the engagement of idiomaticity and its relationship to the generation of material. The *solo viola* series represents an attempt to produce a series of musical works that are formed of material derived from the instrument they are scored for, and not of abstracted material later imposed on any given instrumentation. In this regard, the *solo viola* series can be considered at least in part, successful. It is true that the *solo viola* series is not so explicitly idiomatic that it could not be performed on any other instrument. The *solo viola* series could reasonably be performed on any given string of any given stringed instrument. On the other hand, the *solo viola* series is certainly formed of material that was derived from the viola, and not of abstracted material that was later imposed upon the viola.

chapter three: the solo harp series

The *solo harp* series is comprised of two original compositions. The series is presented in two halves that each form a subset of a single, stand-alone piece: *solo harp ascending*, and *solo harp descending*. The pieces may be performed alone, or together within a single programme. In such a case, the performance of each piece should ideally be interspersed with other programmed works. Each piece within the series is identically scored. As their titles suggest, both pieces are written for solo harp. Each piece requires the same pedal settings¹⁴ as follows: D^b C^b B^b / E^b G^b A^b. The pieces within the *solo harp* series are presented across two saves that are read simultaneously, from left to right.

Each score consists of forty-eight figures. Each figure is formed from two distinct, but overlapped gestures. The first gesture presents four pitches as a simultaneous verticality, or chord. The second gesture is comprised of the same four pitches, but they are given in succession, and sound as an ascending arpeggio¹⁵, rather than a simultaneous chord. The two gestures overlap to form a single hybrid figure. In each figure, the first gesture sounds in unison with the second: in other words, the verticality or chord is heard above the first note of the arpeggio. To clarify, *figure three* outlines the formation of the hybrid figures in the opening of *solo harp ascending*. The first gesture is highlighted in red, whilst the second gesture is highlighted in green.

figure three

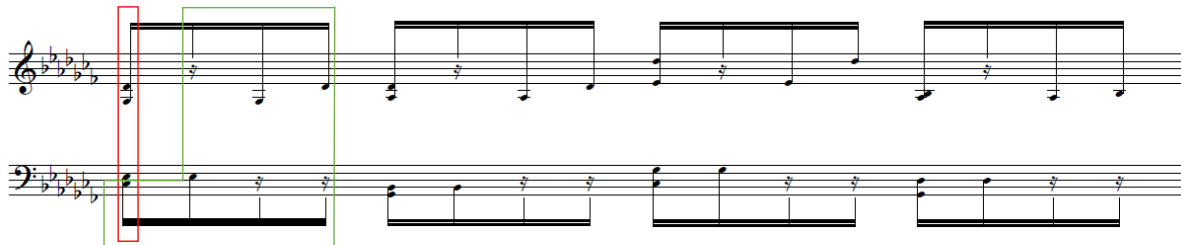


figure three: The formation of hybrid figures in the opening of *solo harp ascending*.

Each hybrid figure is harmonically distinct, but otherwise identical to one another. In any given hybrid figure, a single four-note verticality or chord is outlined. There are only two ‘types’ of chords that are used throughout each piece within the *solo harp* series: C^b major 9th chords, and G^b major 9th chords.

¹⁴ Note: The pedal settings are not altered at any point during either piece.

¹⁵ Rather appropriately, the word *arpeggio* is derived from the Italian word *arpeggiare*, which translates as ‘to play on a harp’ (Hoad, 1996).

Each hybrid figure presents a distinct voicing of a single chord. In other words, each hybrid figure presents an alternative vertical ordering of the notes found within the given chord. Each voicing is unique, and is only used once during each piece within the *solo harp* series. Each piece uses twenty-four distinct voicings of each chord. Each set of twenty-four distinct chord voicings is a direct transposition of the other. There are forty-eight chord voicings used in total during each piece. Both pieces within the *solo harp* series are comprised of the same set of forty-eight chord voicings.

In any given chord voicing, the vertical order of notes is determined by a unique permutation of a four-member set. Each permutation consists of a unique ordering of four components, i.e. [1-2-3-4]. There are twenty-four unique permutations of a four-member set, and each one governs the vertical arrangement of notes within a single chord voicing. In any given permutation, each component, i.e. number, is read as the numerical substitution of an individual component note in each chord, such that [1-2-3-4] is read as [root-third-fifth-ninth]¹⁶. Each chord voicing is generated from the bottom, up. Any given permutation is read from left to right, and thus specifies the vertical order of the component notes in each chord voicing in succession, from the lowest note, to the highest note. Each chord voicing is constructed above a defined fundamental. Every C^b major 9th chord voicing is constructed above a fundamental of C^b3, whilst every G^b major 9th chord voicing is constructed above a fundamental of G^b2. At any given point in the construction of each chord voicing, each successive component note is assigned the lowest possible registral placement, so that each component note is both: (a) higher than or equal to the defined fundamental; and (b) higher than the note that proceeded it.

The harmonic structure of each piece within the *solo harp* series is determined by two complete sequences of permuted chord voicings. Each sequence is comprised of the twenty-four distinct permutations of a four-member set, wherein each permutation represents a distinct chord voicing (aforementioned). Both pieces contain an ascending, and descending sequence of permuted chord voicings. In each piece, the two sequence are sounded consecutively, i.e. one after another, to form a single hybrid sequence of permuted chord voicings.

In each ascending sequence, the twenty-four distinct permutations of four-member set are arranged from [1-2-3-4] to [4-3-2-1]. Each permutation is generated by listing the smallest component possible at any given point. The sequence of permutations is then sorted into ascending order according to the first, second, and third component of each permutation in turn.

In each descending sequence, the twenty-four distinct permutations of a four-member set are arranged from [4-3-2-1] to [1-2-3-4]. Each permutation is generated by listing the largest component possible at any given point. The sequence of

¹⁶ To clarify, [1-2-3-4] should be read as [C^b-E^b-G^b-D^b] for a C^b major 9th chord, and as [G^b-B^b-D^b-A^b] for a G^b major 9th chord.

permutations is then sorted into descending order according to the first, second, and third component of each permutation in turn.

Each sequence is comprised of both C^b major 9th chord voicings, and G^b major 9th chord voicings. In any given sequence, each consecutive chord voicing outlines an alternate chord¹⁷. In other words, each sequence forms a looped chord progression that alternates between each chord as follows: C^b major 9th, G^b major 9th. Both the ascending and descending sequences begin with a C^b major 9th chord voicing, and end with a G^b major 9th chord voicing.

In each complete sequence of twenty-four chord voicings, there are only twelve distinct chord voicings of each chord. Each sequence presents half the given voicings of each chord, i.e. C^b major 9th, and G^b major 9th. The entire aggregate of chord voicing for each chord is divided equally between each sequence. In other words, each sequence is comprised of the twelve chord voicings, that the other sequence does not use.

In *solo harp ascending*, the harmonic structure is governed by a hybrid sequence of permuted chord voicings that is comprised of an ascending sequence, and a descending sequence, i.e. a sequence from [1-2-3-4] to [4-3-2-1], followed by [4-3-2-1] to [1-2-3-4]. The harmonic structure of *solo harp ascending*, is outlined in *appendix six*.

In *solo harp descending*, the harmonic structure is governed by a hybrid sequence of permuted chord voicings that is comprised of a descending sequence, and an ascending sequence, i.e. a sequence from [4-3-2-1] to [1-2-3-4], followed by [1-2-3-4] to [4-3-2-1]. The harmonic structure of *solo harp descending*, is outlined in *appendix seven*.

To clarify: if the ascending sequence of permuted chord voicings was termed, [A], and the descending sequence of permuted chord voicings was termed, [B]; then the structure of *solo harp ascending* could be summarised as [A-B], whilst the structure of *solo harp descending* could be summarised as [B-A]. Essentially each piece operates as a harmonic palindrome. In any given piece, the junction between the consecutive sequences is delineated by transposition: at the mid-point of each piece, the movement from one chord voicing to the next is achieved by direct transposition.

In the first instance, the *solo harp* series was inspired by *preliminary thoughts*, a piece composed by Michael Winter in 2016. To be specific, the conception of the *solo harp* series was inspired by the guitar part within *preliminary thoughts* (2016). In *preliminary thoughts*, Michael Winter presents the text to a musical letter that is read during the performance of the guitar part. Throughout the piece, the guitar 'repeatedly plays the strings successively in descending order, always sounding the second harmonics' (Winter, 2016). Essentially, the guitar part consists of a series of looped figures that contain identical pitch

¹⁷ For the most part, i.e. with the exception of the mid-point of each piece (see page X, paragraph five), this pattern avoids establishing a relationship of direct transposition between successive chords.

material, but varied rhythmic material. Each figure in *preliminary thoughts* is varied so that 'as many different sets of durations are heard' (Winter, 2016). In response, the *solo harp* series essentially reverses the relationship between the 'rhythmic' material and the 'pitch' material that is observed in *preliminary thoughts*. To clarify: the *solo harp* series is comprised of a series of looped figures that contain identical 'rhythmic' material, but vary in pitch material.

Meanwhile, the *solo harp* series was also conceived as a response to the composer's perceived complexity of the construction of the *solo viola* series. The *solo harp* series can be described as a reaction against this perceived complexity of the *solo viola* works, and thereby represents a renewed exploration of minimal simplicity. The minimalist presentation of the *solo viola* series projects a façade that contradicts the complexity of its construction. The *solo harp* series represents an attempt to consciously adapt an approach to composition that is characterized by an austerity of material, and means. In this regard, the *solo harp* series can be considered a conceptual mirror image to the *solo viola* series.

The contrast between the two series can be observed in relation to another aspect of their construction: the approach to the development of material. Whilst the material within the *solo viola* series was derived from the instrument it was scored for, the material within the *solo harp* series was not. The material within the *solo harp* series exists as a distinct entity, that does not require contextualisation within any given instrumental or ensemble setting. In other words, the *solo harp* series is comprised of two musical works that are formed from abstracted material, that has been imposed upon the *solo harp* instrumentation.

Nonetheless, it does not necessarily follow that the material within the *solo harp* series has not been shaped by the instrumentation thereof. Indeed, the material within the *solo harp* series was originally conceived in C major, and was first scored for the classical guitar¹⁸. However, the material could not be performed in its entirety, by a human, using a classical guitar. As such, the material was adapted to fit an alternative instrumental setting, i.e. the solo harp. In the process of adapting the material to this new setting, the material was transposed down a semitone, to C^b major. This allowed the material to take advantage of the harp strings at their longest and most resonant setting. Nonetheless, the material within the *solo harp* series was not specifically derived from the instrument it was scored for, the material was merely adapted to better suit it. Whilst the *solo harp* series is not un-idiomatic, it certainly has not been constructed to be explicitly so. For instance, it is possible for the material to be realised within another instrumental setting. It is reasonable to suggest that the *solo harp* series could have been scored for solo piano.

¹⁸ In part as a reflection of the guitar part in Michael Winter's *preliminary thoughts* (2016).

chapter four: the four saxophones series

The *four saxophones* series was written for The Quasar Saxophone Quartet, and is comprised of forty-eight original compositions. The series is presented in two halves that each form a sub-set of twenty-four individual, stand-alone pieces: *four saxophones ascending (i-xxiv)*, and *four saxophone descending (i-xviii)*. Each piece may be performed alone, or together in combination with any number of other pieces from the series¹⁹. In such a case, the performance of each piece should ideally be interspersed with other programmed works. To date, only two pieces have been realised (i.e. scored): *four saxophones ascending (i)*, and *four saxophones descending (i)*. Each piece within the series is identically scored. As their titles suggest, the pieces are written for four saxophones: a soprano saxophone in B^b, an alto saxophone in E^b, a tenor saxophone in B^b, and a baritone saxophone in E^b.

Each piece is presented as a set of four individual scores or parts, one for each performer. A combined score does not exist for any piece within the *four saxophones* series. The scores are essentially text-based: each score consists of a sequence of four hundred and eighty letters. The letters are arranged to form twenty lines of equal length. Each line contains twenty-four letters that are presented in six groups of four letters. There are four lines on every page, and there are five pages in total. The scores should be read line by line: from left to right, top to bottom, and page by page.

In all, the text-based scored of the *four saxophones* series use three types of letters: black uppercase letter, red uppercase letters, and grey lowercase letters. An uppercase letter gives the name of an individual note to be played by each performer²⁰. The uppercase letters are colour coded to indicate the register in which the given note should be played. A black letter indicates that the specified note should be played *without* the register key, whereas a red letter indicates that the specified note should be played *with* the register key.

In any score, each lowercase letter indicates an individual action of another performer. That is, the lowercase letters are used to indicate when another performer has an instruction to play. Each lowercase letter gives the initial of the saxophone that is instructed to play the next sound, i.e. [Baritone-Tenor-Alto-Soprano]. As such, whilst there are four distinct lowercase letters used throughout the *four saxophones* series, there are only three distinct lowercase letters that appear in any given score.

In short, the scores specify all individual sounds and their succession. Each performer is responsible for determining the exact placement of their individual sound within the given framework. In any given moment, each performer will take one of three

¹⁹ Performers may choose to perform a selection of pieces from each sub-set individually, or otherwise.

²⁰ Note: all note names are written in transposition.

possible actions by either: (a) overlapping their sound with another sound; or (b) playing their sound in immediate succession to another sound; or (c) by playing their sound after a period of 'silence'²¹.

Each performer is responsible for determining the duration of their individual sounds. As such, the total duration of each performance can vary. The combined actions of each performer determine the total duration of each performance. Ideally, these decisions should be made in the moment of performance, and not in advance.

The combined actions of each performer also determine the total number of saxophones that sound during any given moment. In all, there are five possible textural arrangements: (i) no saxophones sounding; (ii) one saxophone sounding; (iii) two saxophones sounding; (iv) three saxophones sounding; or (v) four saxophones sounding.

The *four saxophones* series was first conceived in response to the *solo organ* series. The *four saxophones* series represents an alternative presentation of the structural model presented by the *solo organ* series. Both the *four saxophones* series and the *solo organ* series use the same basic structural concept: each series uses a sequence of permutations to govern the selection and succession of individual sounds. Essentially, the *four saxophones* series translates the structural concept presented by the *solo organ* series to an ensemble setting.

In the construction of the *four saxophones* series, the selection and succession of individual sounds is governed by a sequence comprised of the permutations of a four-member set. Each permutation consists of unique ordering of four components [1-2-3-4]. There are twenty-four unique permutations of a four-member set. In any given permutation, each component, i.e. number, is read as a numerical substitution of an individual performer or instrument, such that [1-2-3-4] is read as [Baritone-Tenor-Alto-Soprano]. Each permutation is read from left to right, and thus specifies the succession of individual sounds or actions.

In *four saxophones ascending (i)*, the selection and succession of individual sounds is governed by an ascending sequence of permutations. The twenty-four distinct permutations of a four-member set are arranged in ascending order, from [1-2-3-4] to [4-3-2-1]. Each permutation is generated by listing the smallest component possible at any given point. The sequence of permutations is then sorted in ascending order according to the first, second, and third component of each permutation in turn. In *four saxophones ascending (i)*, the ascending sequence of twenty-four permutations is looped, i.e. repeated, five times.

²¹ To clarify: in this context 'silence' is understood as any given moment during which no performer is actively playing a note.

In *four saxophones descending (i)* the selection and succession of individual sounds is governed by a descending sequence of permutations. The twenty-four distinct permutations of a four-member set are arranged in descending order, from [4-3-2-1] to [1-2-3-4]. Each permutation is generated by listing the largest component possible at any given point. The sequence of permutations is then sorted in descending order according to the first, second, and third component of each permutation in turn. In *four saxophones descending (i)*, the descending sequence of twenty-four permutations is looped, i.e. repeated, five times.

The most significant difference between the *solo organ* series and the *four saxophones* series is that the latter does not use any borrowed source material to provide the basic pitch material. The *four saxophones* series does not, therefore, re-contextualise any borrowed source material.

The pitch material within the *four saxophones* series was generated within a G major pentatonic pitch space, i.e. [G-A-B-D-E]. Each piece consists of a looped chord progression that is comprised of five chords (i-ii-iii-iv-v). Each chord contains four notes, and represents a distinct four-note sub-set of the G major pentatonic pitch space as follows: i, [G-A-B-D]; ii, [G-A-B-E]; iii, [G-A-D-E]; iv, [G-B-D-E]; v, [A-B-D-E]. In *four saxophones ascending (i)* the chord progression is sounded in ascending order as follows: i-ii-iii-iv-v. In *four saxophones descending (i)* the chord progression is sounded in reverse, i.e. descending order as follows: v-iv-iii-ii-i. In each piece, the given chord progression is looped, i.e. repeated, twenty-four times.

As in the *solo organ* series, the component notes of each chord are sounded in succession, rather than as a simultaneous chord. The pitch material essentially plays through the looped chord progression one note at a time. As such, each of the five chords in the looped chord progression can be considered as a cycle of four component notes. In any given chord or cycle, the derivation of pitch material is determined in parallel to the succession of individual parts, i.e. the order in which the saxophones sound.

At any given point in *four saxophones ascending (i-xxiv)*, each saxophone is assigned the lowest possible component note. In any given four-note cycle or chord, each saxophone is assigned the lowest possible component note that: (a) is higher than the note the given saxophone played in the previous four-note cycle or chord; and (b) that has not yet been played within the given four-note cycle or chord. At no point in any saxophone part will two consecutive notes be the same.

At any given point in *four saxophones descending (i-xxiv)*, each saxophone is assigned the highest possible component note. In any given four-note cycle or chord, each saxophone is assigned the highest possible component note, that: (a) is lower than the note that the given saxophone played in the previous four-note cycle or chord; and (b) that has not yet been played within the given four-note cycle or chord. At no point in any saxophone part will two consecutive notes be the same.

In the construction of the *four saxophones* series, the processes that govern the selection and succession of individual sounds run concurrently until they reach a point of alignment. As such, throughout the *four saxophones* series, each sequence of twenty-four permutations that govern the succession of individual sounds is looped, i.e. repeated five times. Furthermore, throughout the *four saxophones* series, the five-chord chord progression is looped, i.e. repeated twenty-four times.

The registral placement of each component note is determined by an independent process. Each component note can be played in one of two registers as follows: [A] the octave above the register key; or [B] the octave below the register key. In any given piece, and in any given part, each component note is played in an alternative register every time it is sounded. In *four saxophones ascending (i)*, the registral placement of each component note alternates in succession between the lowest register (a), and the highest register (b). In *four saxophones descending (i)*, the inverse is true, the registral placement of each component note alternates in succession between the highest register [A], and the lowest register [B].

chapter five: the ten clarinets series

The *ten clarinets* series is comprised of eight original compositions. The series is presented in two halves that each form a sub-set of four individual, stand-alone pieces: *ten clarinets ascending (i-iv)*, and *ten clarinets descending (i-iv)*. Each piece may be performed alone, or together in combination with any number of other pieces from the series²². In such a case, the performance of each piece should ideally be interspersed with other programmed works. Each piece within the series is identically scored. As their titles suggest, the eight pieces are written for ten clarinets. In each piece, the instrumentation is devised as two identical groups of five clarinets, i.e. quintets. Each quintet forms a distinct ensemble that consists of the following instruments: a clarinet in E^b, a clarinet in B^b, a clarinet in A, an alto clarinet in E^b, and a bass clarinet in B^b. Each piece within the *ten clarinets* series requires two identical clarinet quintets. To clarify, each piece requires two of each specified instrument. The quintets are delineated spatially during live performance: each score specifies that each quintet should be placed 'in a separate area of the same space'.

Each piece is written as a single score. In any given piece, the performers read from identical copies of the full score. Individual parts have not been written for any piece within the *ten clarinets* series. Each score is presented across five staves that should be read simultaneously, from left to right, and page by page. The scores are written in transposition, and accidentals apply only to the notes they proceed.

In any given piece, the two quintets never play simultaneously, but in alternating succession, i.e. one after another. As such, the score has been designed so that both quintets read from the same five staves, thereby reducing the number of required staves by half. Each one of the five staves [i-ii-iii-iv-v], corresponds to a single 'type' of clarinet as follows: the clarinets in E^b, [i]; the clarinets in B^b, [ii]; the clarinets in A, [iii]; the alto clarinets in E^b, [iv]; and the bass clarinets in B^b, [v].

In each score, a combination of two stemless note heads is used to indicate which quintet should play at any given point. The scores use a combination of open (white) and closed (black) note heads. To be specific, in each score, a closed (black) note head indicates a pitch that should be played by quintet one; whereas an open (white) note head indicates a pitch that should be played by quintet two. The use of two distinct note head styles should not be interpreted as an indication of any durational ratios or values. The only purpose of the varied note heads is to indicate which quintet should play at any given point, and thereby make each score easier to read. Furthermore, each score includes a number of physical breaks in each

²² Performers may choose to perform a selection of pieces from each sub-set individually, or otherwise.

stave that visually delineate the material of each quintet in turn. Once again, the only purpose of these visual breaks is to make each score easier to read, and they should not be interpreted as an indication of a performative break or pause²³.

Each piece in the *ten clarinets* series is comprised of four chords: C major 7th, A minor 7th, D minor 7th, and G dominant 7th. Each chord within the *ten clarinets* series is comprised of five notes: two roots, a third, a fifth, and a seventh. In the ascending sub-set of four pieces, i.e. *ten clarinets ascending (i-iv)*, the chords are presented in the following looped chord cycle: C major 7th, A minor 7th, C major 7th, A minor 7th, D minor 7th, G dominant 7th, D minor 7th, G dominant 7th. In the descending sub-set of four pieces, i.e. *ten clarinets descending (i-iv)*, the chords are presented in the following looped chord cycle: D minor 7th, G dominant 7th, D minor 7th, G dominant 7th, C major 7th, A minor 7th, C major 7th, A minor 7th. Throughout each piece in the *ten clarinets* series, every major or dominant seventh chord, i.e. every C major 7th chord, and every G dominant 7th chord, is played by quintet one, whilst every minor chord, i.e. every A minor 7th chord, and every D minor 7th chord, is played by quintet two.

In each piece, every chord sounds as a simultaneous verticality, and is repeated five times in succession. In each cycle of the looped chord progression, four distinct chord voicings are used. In any given cycle of the looped chord progression, each component chord appears in a single chord voicing throughout the given cycle. In addition, each cycle of the looped chord progression is harmonically distinct from one another: each cycle presents an alternative vertical ordering of the component notes of each given chord.

In this regard, there are a number of similarities that can be drawn between the *ten clarinets* series and the *solo harp* series. The *ten clarinets* series was first conceived in response to the *solo harp* series, and represents a direct development of the harmonic language used within the *solo harp* series. The *ten clarinets* series essentially retains the same approach to harmonic language as used within the *solo harp* series, but expands upon it, not least by adapting it to an ensemble setting.

To clarify, both the *solo harp* series and the *ten clarinets* series are formed from a number of looped chord progressions, or cycles, that are harmonically distinct from one another according to the vertical ordering of the component notes of each given chord. Essentially, both series are constructed by using a variety of distinct voicings for each component chord. Meanwhile, the *ten clarinets* series also represents a clear expansion of the harmonic language used within the *solo harp* series. For instance, each chord voicing within the *ten clarinets* series is comprised of five notes, whereas each chord voicing within the *solo harp* series is comprised of four notes. In addition, the *ten clarinets* series is constructed using a total of four different ‘types’ of chord, whereas the *solo harp* series is constructed using a total of two different ‘types’ of chord.

²³ Indeed, it is only reasons of economy that prohibit the scores from being colour-coded to improve their clarity further.

Nonetheless, in the construction of both the *solo harp* series and the *ten clarinets* series, the same procedure for the generation of chord voicings was followed. In both the *solo harp* series and the *ten clarinets* series, any given chord voicing is generated according to a distinct permutation of an n -membered set, where n is the number of component notes in each chord. As such, throughout the *ten clarinets* series, the vertical ordering of notes in any given chord voicing is determined by a unique permutation of a five-member set. Each permutation consists of a unique ordering of five components [1-2-3-4-5]. There are one-hundred and twenty unique permutations of a five-member set, and each one governs the vertical arrangement of notes within a single chord voicing.

In any given permutation, each component, i.e. number, is read as the numerical substitution for an individual component note of each chord, such that [1-2-3-4-5] is read as [root-third-fifth-seventh-root]²⁴. Each voicing is generated from the bottom, up. Any given permutation is read from left to right, and thus specifies the vertical order of the component notes in each chord voicing in succession, from the lowest note, to the highest note. Throughout the *ten clarinets* series, each chord voicing is constructed above a defined fundamental. Every C major 7th chord voicing is constructed above a fundamental of C3. Every A minor 7th chord voicing is constructed above a fundamental of A2. Every D minor 7th chord voicing is constructed above a fundamental of D3. Every G dominant 7th chord voicing is constructed above a fundamental of G2. At any given point in the construction of each chord voicing, each successive component note is assigned the lowest possible registral placement, so that each component note is both: (a) higher than or equal to the defined fundamental; and (b) higher than the note that proceeded it.

Although there are one-hundred and twenty distinct permutations of a five-member set, it is not possible to generate the same number of distinct voicings of each chord used within the *ten clarinets* series. This phenomenon occurs because every chord used within the *ten clarinets* series has two component notes that are the same, i.e. each chord voicing contains two roots. As such, whilst there are one-hundred and twenty distinct vertical arrangements of the component notes of any given five-note chord, if two component notes within the given chord are the same, then half of the generated voicings will sound identical to the other²⁵. In essence, for any given chord in the *ten clarinets* series, there are sixty distinct voicings of each chord, but each chord voicing is generated twice.

²⁴ To clarify, [1-2-3-4-5] should be read as [C-E-G-B-C] for a C major 7th chord; as [A-C-E-G-A] for an A minor 7th chord; as [D-F-A-C-D] for a D minor 7th chord; and as [G-B-D-F-G] for a G dominant 7th chord.

²⁵ Consider, for example, the permutations [1-5-2-3-4] and [5-1-2-3-4]; both permutations produce an identical chord voicing, because both permutations are read as [root-root-third-fifth-seventh].

In the construction of the *ten clarinets* series, the one-hundred and twenty voicings of each chord were arranged in a sequence according to the total intervallic range of each voicing in turn. In other words, for any given chord, the corresponding set of voicings were ordered according to the harmonic interval between the lowest pitch and the highest pitch in each given voicing in turn.

For every major seventh, and dominant seventh chords, the corresponding set of chord voicings were arranged from the voicing with the most compressed, i.e. smallest, intervallic range; to the chord voicing with the most expanded, i.e. largest, intervallic range. The inverse is true for every minor seventh chord: the corresponding set of chord voicings were arranged from the voicing with the most expanded, i.e. largest, intervallic range; to the voicing with the most compressed, i.e. smallest, intervallic range.

As each series of chord voicings contains sixty pairs of identical voicing, each sequence of chord voicings was bifurcated to form two identical sub-sequences. In any given series of chord voicings, each sub-sequence is formed from the same sixty chord voicings. In each series of chord voicings, the corresponding sub-sequences were arranged in succession, to form a mirror image of one another. Essentially, each sub-sequence was arranged to generate a hybrid sequence that formed a palindrome. Hence for every major seventh, and dominant seventh chords, the corresponding series of chord voicings were arranged to form a hybrid sequence from the most compressed, intervallic range, to the most expanded intervallic range, to the most compressed intervallic range again. Likewise, for every minor seventh chord, the corresponding series of chord voicings were arranged to form a hybrid sequence from the most expanded intervallic range, to the most compressed intervallic range, to the most expanded intervallic range again.

chapter six: the sixteen lines series

The *sixteen lines* series is comprised of two original compositions. The series is presented in two halves that each form a sub-set of a single, stand-alone piece: *sixteen lines ascending*, and *sixteen lines descending*. The pieces may be performed alone, or together within a single programme, ideally interspersed with other programmed works. Each piece within the series is identically scored. As their titles suggest, both pieces are presented in sixteen parts, or lines. Each line is written in concert pitch, but the instrumentation is not specified. Performers may arrange each piece for ‘up to sixteen players’. Both scores should be read from left to right, and page by page. The *sixteen lines* series is dedicated with compliments to Johann Sebastian Bach and Rachel Whiteread.

In the first instance, the *sixteen lines* series was inspired by the work of the artists, Rachel Whiteread, CBE (1963). Whiteread is an English artist who is perhaps best known for her production of minimalist sculpture. Her sculptures are often constructed from the ‘casts of domestic features or the spaces around them (such as the space under a bed)’ (Chilvers, 2015). Much of Whiteread’s sculptural work involves the exploration of negative space, and more specifically, the translation of negative space into solid form. Whiteread is particularly famous for *House* (1993), a site-specific sculpture which involved taking a concrete cast of an entire house in Grove Road in the East End of London (Chilvers, 2015). *House*, was controversially demolished in 1994, though the reasons for its destruction ‘were more to do with bureaucracy than aesthetics’ (Chilvers & Graves-Smith, 2015). Whiteread became the first woman to win the annual Turner Prize in 1993, partly as a result of *House*, which the Turner jury praised for ‘its combination of austere monumentality and immediacy of reference to the everyday world’, its ‘haunting qualities’ and its ‘poetic strangeness’ (Chilvers & Graves-Smith, 2015).

The *sixteen lines* series was first conceived as a musical response to the sculptural work of Rachel Whiteread. In essence, the *sixteen lines* series was created as an attempt to produce the musical equivalent of a Rachel Whiteread sculpture: each piece within the *sixteen lines* series represents the musical cast of an existing composition. To be specific, each piece within the *sixteen lines* series represents a unique realisation of an attempt to form a musical cast of the *Prelude in C Major* from J.S. Bach’s *Prelude and Fugue in C Major BWV 846*.

Ultimately, the premise of the *sixteen lines* series, is remarkably simple: each piece within the series takes a musical cast of the extremities, and internal space within J.S. Bach’s *Prelude in C Major*. In short, each piece within the *sixteen lines* series has been designed so that the negative space contained within it, should take the form of J.S. Bach’s *Prelude in C Major*.

At any given moment within each piece in the *sixteen lines* series, the pitch material is generated by specifying every chromatic pitch that is not sounding in J.S. Bach’s *Prelude in C major* at the given time, and that: (a) is a semitone higher than the highest pitch sounding within J.S. Bach’s *Prelude in C major* at the given time; (b) is a semitone lower than the lowest

pitch sounding within J.S. Bach's *Prelude in C Major* at the given time; and (c) occurs within the pitch space defined between the lowest, and highest pitches sounding within J.S. Bach's *Prelude in C Major* at the given time.

As such, if one were to notate exactly which pitches do not sound throughout both pieces in the *sixteen lines* series, and that occur within the pitch space defined between the highest and lowest pitches being sounded at any given point; then the entirety of J.S. Bach's *Prelude in C Major* from *Prelude and Fugue in C major BWV 846*, would be transcribed onto the page. In other words, the negative space contained within both *sixteen lines ascending*, and *sixteen lines descending*, takes the form of J.S. Bach's *Prelude in C Major*.

The pitch material within the *sixteen lines* series spans four octaves. In each piece within the series, the entire chromatic pitch space in a single octave is presented across four instruments or lines, and within a single demi-semiquaver triplet. Essentially, the twelve chromatic pitches in any given octave are sounded as three consecutive verticalities that are each comprised of four pitches. By presenting the chromatic aggregate of each octave in this way, it has been possible to reduce the number of instrument required to play any given octave, from twelve, to four.

In each piece within the *sixteen lines* series, the arrangement of pitch material was determined according to an individual template. Each template specifies the distribution of the pitches of the full chromatic aggregate across four octaves. In the construction of each piece within the *sixteen lines* series, the pitches that sound within J.S. Bach's *Prelude in C Major*, were simply removed from each template. In doing so, each demi-semiquaver triplet was taken to correspond to a single semiquaver within J.S. Bach's original *Prelude in C Major* from the *Prelude and Fugue in C major BWV 846*. As such, the pitches that remained, represented a musical cast of the extremities, and internal pitch space within J.S. Bach's *Prelude in C Major*. For clarification, the template used in the construction of *sixteen lines ascending*, is detailed in *appendix eight*, and the template used in the construction of *sixteen lines descending*, is detailed in *appendix nine*.

The *sixteen lines* series could arguably have included another dedication, to Eric Morecambe²⁶ and Ernie Wise²⁷. In a famous 1971 television sketch performance, Eric Morecambe plays the piano in a performance of Edvard Greig's 1868 *Piano Concerto in A minor, Op. 16*, that is conducted by Andre Previn (who is introduced on-stage as Mr Andre Preview). Simon P. Keefe (2011, p.1), described the performance in detail, as follows: Morecambe delivers a grotesquely butchered version of the main theme. Reprimanded by Previn for 'playing all the wrong notes', Morecambe purses his lips, grabs his conductor by the lapels and... delivered his coup de grace: 'I'm playing all the right notes, but not necessarily in the right order'. Taking

²⁶ John Eric Bartholomew (1926-1984).

²⁷ Ernest Wiseman (1925-1999).

inspiration from this famous pronouncement, each piece within the *sixteen lines* series, could be described as playing all the wrong notes in J.S. Bach's *Prelude in C major*, but in exactly the right order.

conclusion(s)

This thesis has examined each series of works contained within the portfolio of compositions that has been presented in this submission. Each chapter was dedicated to the discussion of a single series contained within the portfolio.

In the discussion of my recent compositional work, this thesis has (a) identified the nature of the rudimentary material contained within each given series, (b) defined how the rudimentary material contained within each given series was generated, and (c) defined how the rudimentary material has been used throughout each given series to formalize each given piece.

The discussion of my recent compositional work has drawn attention to the conceptual nature of much of the work presented within the portfolio. Furthermore, with regards to my conceptual works, this thesis has outlined the theory and application of each given concept, and attempted to account for the influences that have governed the conception and development of each conceptual work.

In the same manner, this thesis has drawn attention to, and accounted for the use of borrowed materials within my recent compositional work. It has also outlined the processes used in the recontextualization of said borrowed material.

By doing so, this thesis has aided the understanding and appreciation of the compositional work presented within this portfolio. In general, this has allowed me to draw a number of conclusion regarding the nature of my recent compositional work:

- i. My compositional work can be characterised by the use of austere, pared-back, minimal materials.
- ii. My compositional work is fundamentally conceptual, in which the idea(s) or concept(s) are considered the most important aspect of the work.
- iii. My compositional work is process-led, which draws attention to the inherent materiality of the work.
- iv. In much of my compositional work, the concept and process are one and the same.
- v. In my compositional work, process governs the generation and formalization of the material presented within it.
- vi. My compositional work has developed permutation as a compositional device. My most recent compositional work has deployed permutation as a device in the generation and formalising of material. This allows discrete material to be (a) exhausted to completion, and (b) formalised into logical, often rule-based structures.
- vii. My compositional work can therefore be characterised by the 'very small range of contrast' in contains (Johnson, 1989, p.23).

- viii. My compositional work is non-metaphorical, and non-representational; to paraphrase Frank Stella, it is what it is (Gough, 2007, p.98)
- ix. This draws attention to the conceptual nature of the work, and allows the music to be identified as ‘nothing other than its constitutive unaltered materials and explicit mode of construction’ (Gough, 2001, p.98).
- x. My compositional work is fundamentally, minimalist.

In short, this thesis has drawn attention to the ‘severity of means, clarity of form, and simplicity of structure and texture’ that characterises each given work presented within the portfolio of original compositions. By doing so, this thesis has gone some way to demonstrate why my compositional work may be considered as minimal, or minimalist.

My work has suggested how process and minimalism could be intrinsically linked. My work has shown that the use of process can be a significant factor in strengthening the inherent materiality of minimal music. My work has demonstrated how process may be used to exhaust material to completion, and formalise material into logical, often rule-based structures. My work has developed permutation as a compositional device used in the generation and formalisation of material.

My work has also demonstrated how the presentation of the work, i.e. the visual aspects of the score might be used to compliment the aesthetic principals that provide the impetus behind the creation of the music in and of itself. My approach to the presentation of each score been guided by the following key principals: (a) to communicate what is entirely essential, and no more; (b) to be as clear, concise, and simple in communication as possible and (c) to show, rather than tell. My recent compositional work has implied that a musical score can be considered as an art form, i.e. literal artistic artefact, in and of itself.

Ultimately, this study has gone some way to understand and characterise my own creative practice, and thereby consider the contextualisation thereof within wider contemporary compositional practices. Most significantly, this thesis has demonstrated that such a study is never completed, and by striving to understand, characterise, and account for the aesthetic impetus behind my own creative practice, one can discover new avenues of research which my creative practice may explore in the future.

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appendix one

verticality		pitch material				action(s)	active parts				permutation		sucession of active parts				action one				action two				action three				action four			
no.	text	B	T	A	S						no.	substitution					B	T	A	S	B	T	A	S	B	T	A	S	B	T	A	S
i	A	Eb 3	Bb 3	Eb 4	G 4	4	B	T	A	S	1 24	[1-2-3-4]	B	T	A	S	Eb 3					Bb 3					Eb 4					G 4
iii	bide	Bb 2		D 4		2	B		A		1 2	[1-2]	B	A			Bb 2						D 4									
iii	with		Ab 3		F 4	2		T		S	2 2	[2-1]	S	T					F 4			Ab 3										
iv	me	C 3	G 3	Eb 4	Eb 4	4	B	T	A	S	2 24	[1-2-4-3]	B	T	S	A	C 3					G 3					Eb 4			Eb 4		
v	fast	G 2	Eb 3		Bb 4	3	B	T		S	1 6	[1-2-3]	B	T	S		G 2					Eb 3					Bb 4					
vi	falls	Ab 2			C 5	2	B			S	1 2	[1-2]	B	S			Ab 2							C 5								
vii	the	Bb 2	Bb 3	D 4	Bb 4	4	B	T	A	S	3 24	[1-3-2-4]	B	A	T	S	Bb 2						D 4			Bb 3						Bb 4
viii	e	C 3		Eb 4		2	B		A		2 2	[2-1]	A	B					Eb 4		C 3											
ix	ven	D 3		F 4	Ab 4	3	B		A	S	2 6	[1-3-2]	B	S	A		D 3							Ab 4			F 4					
x	tide	Eb 3		Eb 4	G 4	3	B		A	S	3 6	[2-1-3]	A	B	S				Eb 4		Eb 3							G 4				
xii	–	D 3				1	B				n/a	n/a	B				D 3															
xiii	dark	C 3	Ab 3		Ab 4	3	B	T		S	4 6	[2-3-1]	T	S	B			Ab 3						Ab 4	C 3							
xiv	ness	Bb 2	G 3		Bb 4	3	B	T		S	5 6	[3-1-2]	S	B	T					Bb 4	Bb 2					G 3						
xv	deep	Ab 2	Ab 3		C 5	3	B	T		S	6 6	[3-2-1]	S	T	B					C 5		Ab 3			Ab 2							
xvi	ens	Eb 3	G 3		Bb 4	3	B	T		S	1 6	[1-2-3]	B	T	S		Eb 3					G 3						Bb 4				
xvii	Lord	F 3	C 4		Ab 4	3	B	T		S	2 6	[1-3-2]	B	S	T		F 3							Ab 4		C 4						
xviii	with	D 3	Bb 3	F 4	F 4	4	B	T	A	S	4 24	[1-3-4-2]	B	A	S	T	D 3						F 4				F 4		Bb 3			
xix	me	Eb 3		Eb 4	G 4	3	B		A	S	3 6	[2-1-3]	A	B	S				Eb 4		Eb 3						G 4					
xx	a	C 3	Eb 3		A 4	3	B	T		S	4 6	[2-3-1]	T	S	B			Eb 3						A 4	C 3							
xxi	bide	Bb 2	F 3	D 4	Bb 4	4	B	T	A	S	5 24	[1-4-2-3]	B	S	T	A	Bb 2							Bb 4		F 3				D 4		
xxii	when	Eb 3	G 3	Eb 4	G 4	4	B	T	A	S	6 24	[1-4-3-2]	B	S	A	T	Eb 3								G 4		Eb 4			G 3		
xxiii	–		Ab 3			1		T			n/a	n/a	T					Ab 3														
xxiv	oth	Bb 2	Bb 3	D 4		3	B	T	A		5 6	[3-1-2]	A	B	T				D 4		Bb 2					Bb 3						
xxv	ther		Ab 3		F 4	2		T		S	1 2	[1-2]	T	S				Ab 3						F 4								
xxvii	hel	C 3	G 3	Eb 4	Eb 4	4	B	T	A	S	7 24	[2-1-3-4]	T	B	A	S		G 3				C 3					Eb 4					Eb 4
xxvii	per	G 2	Eb 4		Bb 4	3	B	T		S	6 6	[3-2-1]	S	T	B					Bb 4		Eb 4			G 2							
xxviii	ers		D 4			1		T			n/a	n/a	T					D 4														
xxix	fail	Ab 2	C 4			2	B	T			2 2	[2-1]	T	B				C 4				Ab 2										
xxx	and				Ab 4	1				S	n/a	n/a	S								Ab 4											
xxxi	–	Bb 2				1	B				n/a	n/a	B				Bb 2															
xxxii	com	C 3		E 4		2	B		A		1 2	[1-2]	B	A				C 3					E 4									
xxxiii	forts		Bb 3		G 4	2		T		S	2 2	[2-1]	S	T						G 4		Bb 3										
xxxiv	flee	F 3	Ab 3	F 4	F 4	4	B	T	A	S	8 24	[2-1-4-3]	T	B	S	A		Ab 3			F 3						F 4			F 4		
xxxv	help	Ab 3	Bb 3	D 4		3	B	T	A		1 6	[1-2-3]	B	T	A		Ab 3					Bb 3					D 4					
xxxvi	of	G 3		Eb 4	G 4	3	B		A	S	2 6	[1-3-2]	B	S	A									G 4			Eb 4					
xxxvii	the	F 3		D 4	Ab 4	3	B		A	S	3 6	[2-1-3]	A	B	S				D 4		F 3						Ab 4					
xxxviii	help	Eb 3		Eb 4	G 4	3	B		A	S	4 6	[2-3-1]	A	S	B				Eb 4					G 4	Eb 3							
xxxix	less	Bb 2	Ab 3	D 4	F 4	4	B	T	A	S	9 24	[2-3-1-4]	T	A	B	S		Ab 3					D 4		Bb 2						F 4	
xl	O	C 3	G 3	Eb 4	Eb 4	4	B	T	A	S	10 24	[2-3-4-1]	T	A	S	B		G 3					Eb 4			Eb 4	C 3					
xli	a	Ab 2	C 4	F 4	Ab 4	4	B	T	A	S	11 24	[2-4-1-3]	T	S	B	A		C 4						Ab 4	Ab 2					F 4		
xliv	bide	Bb 2	Bb 3	Eb 4	G 4	4	B	T	A	S	12 24	[2-4-3-1]	T	S	A	B		Bb 3						G 4		Eb 4		Bb 2				
xliv	with			D 4	F 4	2			A	S	1 2	[1-2]	A	S					D 4					F 4								
xliv	–		Ab 3			1		T			n/a	n/a	T					Ab 3														
xliv	me	Eb 3	G 3	Eb 4	Eb 4	4	B	T	A	S	13 24	[3-1-2-4]	A	B	T	S			Eb 4		Eb 3					G 3						Eb 4
n/a	n/a	x	x	x	x	4	B	T	A	S	14 24	[3-1-4-2]	A	B	S	T			x		x						x		x			

appendix one: The structure of solo organ ascending.

appendix two

verticality		pitch material				action(s)	active parts				permutation		sucession of active parts				action one				action two				action three				action four			
no.	text	B	T	A	S						no.	substitution					B	T	A	S	B	T	A	S	B	T	A	S	B	T	A	S
i	A	Eb 3	Bb 3	Eb 4	G 4	4	B	T	A	S	24 24	[4-3-2-1]	S	A	T	B				G 4			Eb 4			Bb 3			Eb 3			
iii	bide	Bb 2		D 4		2	B		A		2 2	[2-1]	A	B					D 4		Bb 2											
iii	with		Ab 3		F 4	2		T		S	1 2	[1-2]	T	S				Ab 3					F 4									
iv	me	C 3	G 3	Eb 4	Eb 4	4	B	T	A	S	23 24	[4-3-1-2]	S	A	B	T				Eb 4			Eb 4		C 3				G 3			
v	fast	G 2	Eb 3		Bb 4	3	B	T		S	6 6	[3-2-1]	S	T	B					Bb 4		Eb 3			G 2							
vi	falls	Ab 2			C 5	2	B			S	2 2	[2-1]	S	B						C 5	Ab 2											
vii	the	Bb 2	Bb 3	D 4	Bb 4	4	B	T	A	S	22 24	[4-2-3-1]	S	T	A	B				Bb 4		Bb 3			D 4		Bb 2					
viii	e	C 3		Eb 4		2	B		A		1 2	[1-2]	B	A			C 3						Eb 4									
ix	ven	D 3		F 4	Ab 4	3	B		A	S	5 6	[3-1-2]	S	B	A					Ab 4	D 3				F 4							
x	tide	Eb 3		Eb 4	G 4	3	B		A	S	4 6	[2-3-1]	A	S	B				Eb 4					G 4	Eb 3							
xii	—	D 3				1	B				n/a	n/a	B				D 3															
xiii	dark	C 3	Ab 3		Ab 4	3	B	T		S	3 6	[2-1-3]	T	B	S			Ab 3				C 3					Ab 4					
xiv	ness	Bb 2	G 3		Bb 4	3	B	T		S	2 6	[1-3-2]	B	S	T		Bb 2							Bb 4		G 3						
xv	deep	Ab 2	Ab 3		C 5	3	B	T		S	1 6	[1-2-3]	B	T	S		Ab 2					Ab 3					C 5					
xvi	ens	Eb 3	G 3		Bb 4	3	B	T		S	6 6	[3-2-1]	S	T	B					Bb 4		G 3		Eb 3								
xvii	Lord	F 3	C 4		Ab 4	3	B	T		S	5 6	[3-1-2]	S	B	T					Ab 4	F 3					C 4						
xviii	with	D 3	Bb 3	F 4	F 4	4	B	T	A	S	21 24	[4-2-1-3]	S	T	B	A				F 4		Bb 3			D 3					F 4		
xix	me	Eb 3		Eb 4	G 4	3	B		A	S	4 6	[2-3-1]	A	S	B				Eb 4				G 4	Eb 3								
xx	a	C 3	Eb 3		A 4	3	B	T		S	3 6	[2-1-3]	T	B	S			Eb 3				C 3					A 4					
xxi	bide	Bb 2	F 3	D 4	Bb 4	4	B	T	A	S	20 24	[4-1-3-2]	S	B	A	T				Bb 4	Bb 2					D 4			F 3			
xxii	when	Eb 3	G 3	Eb 4	G 4	4	B	T	A	S	19 24	[4-1-2-3]	S	B	T	A				G 4	Eb 3					G 3				Eb 4		
xxiii	—		Ab 3			1		T			n/a	n/a	T					Ab 3														
xxiv	oth	Bb 2	Bb 3	D 4		3	B	T	A		2 6	[1-3-2]	B	A	T		Bb 2						D 4			Bb 3						
xxv	ther		Ab 3		F 4	2		T		S	2 2	[2-1]	S	T									F 4		Ab 3							
xxvii	hel	C 3	G 3	Eb 4	Eb 4	4	B	T	A	S	18 24	[3-4-2-1]	A	S	T	B			Eb 4				Eb 4		G 3		C 3					
xxvii	per	G 2	Eb 4		Bb 4	3	B	T		S	1 6	[1-2-3]	B	T	S		G 2					Eb 4					Bb 4					
xxviii	ers		D 4			1		T			n/a	n/a	T					D 4														
xxix	fail	Ab 2	C 4			2	B	T			1 2	[1-2]	B	T			Ab 2						C 4									
xxx	and				Ab 4	1				S	n/a	n/a	S								Ab 4											
xxxi	—	Bb 2				1	B				n/a	n/a	B				Bb 2															
xxxii	com	C 3		E 4		2	B		A		2 2	[2-1]	A	B						E 4		C 3										
xxxiii	forts		Bb 3		G 4	2		T		S	1 2	[1-2]	T	S				Bb 3						G 4								
xxxiv	flee	F 3	Ab 3	F 4	F 4	4	B	T	A	S	17 24	[3-4-1-2]	A	S	B	T			F 4				F 4	F 3				Ab 3				
xxxv	help	Ab 3	Bb 3	D 4		3	B	T	A		6 6	[3-2-1]	A	T	B				D 4			D 4			Ab 3							
xxxvi	of	G 3		Eb 4	G 4	3	B		A	S	5 6	[3-1-2]	S	B	A					G 4	G 3					Eb 4						
xxxvii	the	F 3		D 4	Ab 4	3	B		A	S	4 6	[2-3-1]	A	S	B					D 4				Ab 4	F 3							
xxxviii	help	Eb 3		Eb 4	G 4	3	B		A	S	3 6	[2-1-3]	A	B	S					Eb 4		Eb 3					G 4					
xxxix	less	Bb 2	Ab 3	D 4	F 4	4	B	T	A	S	16 24	[3-2-4-1]	A	T	S	B				D 4			Ab 3					F 4	Bb 2			
xl	O	C 3	G 3	Eb 4	Eb 4	4	B	T	A	S	15 24	[3-2-1-4]	A	T	B	S				Eb 4			G 3			C 3					Eb 4	
xli	a	Ab 2	C 4	F 4	Ab 4	4	B	T	A	S	14 24	[3-1-4-2]	A	B	S	T				F 4		Ab 2					Ab 4		C 4			
xlvi	bide	Bb 2	Bb 3	Eb 4	G 4	4	B	T	A	S	13 24	[3-1-2-4]	A	B	T	S				Eb 4		Bb 2				Bb 3					G 4	
xlvi	with			D 4	F 4	2			A	S	2 2	[2-1]	S	A												D 4						
xliv	—		Ab 3			1		T			n/a	n/a	T					Ab 3														
xlvi	me	Eb 3	G 3	Eb 4	Eb 4	4	B	T	A	S	12 24	[2-4-3-1]	T	S	A	B			G 3					Eb 4		Eb 4		Eb 3				
n/a	n/a	x	x	x	x	4	B	T	A	S	11 24	[2-4-1-3]	T	S	B	A			x					x	x					x		

appendix two: The structure of solo organ descending.

appendix three

no.	name	permutations substituted						permutations given					
1	1.A	i	ii	v	vi	iii	iv	[1-2-3]	[1-3-2]	[3-1-2]	[3-2-1]	[2-1-3]	[2-3-1]
2	1.B	i	ii	v	vi	iv	iii	[1-2-3]	[1-3-2]	[3-1-2]	[3-2-1]	[2-3-1]	[2-1-3]
3	1.C	i	ii	vi	iii	iv	v	[1-2-3]	[1-3-2]	[3-2-1]	[2-1-3]	[2-3-1]	[3-1-2]
4	1.D	i	iii	ii	v	vi	iv	[1-2-3]	[2-1-3]	[1-3-2]	[3-1-2]	[3-2-1]	[2-3-1]
5	1.E	i	iii	ii	vi	iv	v	[1-2-3]	[2-1-3]	[1-3-2]	[3-2-1]	[2-3-1]	[3-1-2]
6	1.F	i	iii	iv	v	ii	vi	[1-2-3]	[2-1-3]	[2-3-1]	[3-1-2]	[1-3-2]	[3-2-1]
7	1.G	i	iii	iv	vi	v	ii	[1-2-3]	[2-1-3]	[2-3-1]	[3-2-1]	[3-1-2]	[1-3-2]
8	1.H	i	iv	iii	ii	v	vi	[1-2-3]	[2-3-1]	[2-1-3]	[1-3-2]	[3-1-2]	[3-2-1]
9	1.I	i	iv	iii	ii	vi	v	[1-2-3]	[2-3-1]	[2-1-3]	[1-3-2]	[3-2-1]	[3-1-2]
10	1.J	i	iv	v	ii	vi	iii	[1-2-3]	[2-3-1]	[3-1-2]	[1-3-2]	[3-2-1]	[2-1-3]
11	1.K	i	iv	v	vi	iii	ii	[1-2-3]	[2-3-1]	[3-1-2]	[3-2-1]	[2-1-3]	[1-3-2]
12	1.L	i	iv	vi	iii	ii	v	[1-2-3]	[2-3-1]	[3-2-1]	[2-1-3]	[1-3-2]	[3-1-2]
13	2.A	ii	i	iii	iv	v	vi	[1-3-2]	[1-2-3]	[2-1-3]	[2-3-1]	[3-1-2]	[3-2-1]
14	2.B	ii	i	iii	iv	vi	v	[1-3-2]	[1-2-3]	[2-1-3]	[2-3-1]	[3-2-1]	[3-1-2]
15	2.C	ii	i	iv	v	vi	iii	[1-3-2]	[1-2-3]	[2-3-1]	[3-1-2]	[3-2-1]	[2-1-3]
16	2.D	ii	v	i	iii	iv	vi	[1-3-2]	[3-1-2]	[1-2-3]	[2-1-3]	[2-3-1]	[3-2-1]
17	2.E	ii	v	i	iv	vi	iii	[1-3-2]	[3-1-2]	[1-2-3]	[2-3-1]	[3-2-1]	[2-1-3]
18	2.F	ii	v	vi	iii	i	iv	[1-3-2]	[3-1-2]	[3-2-1]	[2-1-3]	[1-2-3]	[2-3-1]
19	2.G	ii	v	vi	iv	iii	i	[1-3-2]	[3-1-2]	[3-2-1]	[2-3-1]	[2-1-3]	[1-2-3]
20	2.H	ii	vi	iii	i	iv	v	[1-3-2]	[3-2-1]	[2-1-3]	[1-2-3]	[2-3-1]	[3-1-2]
21	2.I	ii	vi	iii	iv	v	i	[1-3-2]	[3-2-1]	[2-1-3]	[2-3-1]	[3-1-2]	[1-2-3]
22	2.J	ii	vi	iv	v	i	iii	[1-3-2]	[3-2-1]	[2-3-1]	[3-1-2]	[1-2-3]	[2-1-3]
23	2.K	ii	vi	v	i	iii	iv	[1-3-2]	[3-2-1]	[3-1-2]	[1-2-3]	[2-1-3]	[2-3-1]
24	2.L	ii	vi	v	i	iv	iii	[1-3-2]	[3-2-1]	[3-1-2]	[1-2-3]	[2-3-1]	[2-1-3]
25	3.A	iii	i	ii	v	vi	iv	[2-1-3]	[1-2-3]	[1-3-2]	[3-1-2]	[3-2-1]	[2-3-1]
26	3.B	iii	i	ii	vi	iv	v	[2-1-3]	[1-2-3]	[1-3-2]	[3-2-1]	[2-3-1]	[3-1-2]
27	3.C	iii	i	iv	v	ii	vi	[2-1-3]	[1-2-3]	[2-3-1]	[3-1-2]	[1-3-2]	[3-2-1]
28	3.D	iii	i	iv	vi	v	ii	[2-1-3]	[1-2-3]	[2-3-1]	[3-2-1]	[3-1-2]	[1-3-2]
29	3.E	iii	ii	i	iv	v	vi	[2-1-3]	[1-3-2]	[1-2-3]	[2-3-1]	[3-1-2]	[3-2-1]
30	3.F	iii	ii	i	iv	vi	v	[2-1-3]	[1-3-2]	[1-2-3]	[2-3-1]	[3-2-1]	[3-1-2]
31	3.G	iii	ii	v	i	iv	vi	[2-1-3]	[1-3-2]	[3-1-2]	[1-2-3]	[2-3-1]	[3-2-1]
32	3.H	iii	ii	vi	iv	v	i	[2-1-3]	[1-3-2]	[3-2-1]	[2-3-1]	[3-1-2]	[1-2-3]
33	3.I	iii	ii	vi	v	i	iv	[2-1-3]	[1-3-2]	[3-2-1]	[3-1-2]	[1-2-3]	[2-3-1]
34	3.J	iii	iv	v	i	ii	vi	[2-1-3]	[2-3-1]	[3-1-2]	[1-2-3]	[1-3-2]	[3-2-1]
35	3.K	iii	iv	vi	v	i	ii	[2-1-3]	[2-3-1]	[3-2-1]	[3-1-2]	[1-2-3]	[1-3-2]
36	3.L	iii	iv	vi	v	ii	i	[2-1-3]	[2-3-1]	[3-2-1]	[3-1-2]	[1-3-2]	[1-2-3]
37	4.A	iv	iii	i	ii	v	vi	[2-3-1]	[2-1-3]	[1-2-3]	[1-3-2]	[3-1-2]	[3-2-1]
38	4.B	iv	iii	i	ii	vi	v	[2-3-1]	[2-1-3]	[1-2-3]	[1-3-2]	[3-2-1]	[3-1-2]
39	4.C	iv	iii	ii	vi	v	i	[2-3-1]	[2-1-3]	[1-3-2]	[3-2-1]	[3-1-2]	[1-2-3]
40	4.D	iv	v	i	ii	vi	iii	[2-3-1]	[3-1-2]	[1-2-3]	[1-3-2]	[3-2-1]	[2-1-3]
41	4.E	iv	v	i	iii	ii	vi	[2-3-1]	[3-1-2]	[1-2-3]	[2-1-3]	[1-3-2]	[3-2-1]
42	4.F	iv	v	ii	vi	iii	i	[2-3-1]	[3-1-2]	[1-3-2]	[3-2-1]	[2-1-3]	[1-2-3]
43	4.G	iv	v	vi	iii	i	ii	[2-3-1]	[3-1-2]	[3-2-1]	[2-1-3]	[1-2-3]	[1-3-2]
44	4.H	iv	v	vi	iii	ii	i	[2-3-1]	[3-1-2]	[3-2-1]	[2-1-3]	[1-3-2]	[1-2-3]
45	4.I	iv	vi	iii	i	ii	v	[2-3-1]	[3-2-1]	[2-1-3]	[1-2-3]	[1-3-2]	[3-1-2]
46	4.J	iv	vi	iii	ii	v	i	[2-3-1]	[3-2-1]	[2-1-3]	[1-3-2]	[3-1-2]	[1-2-3]
47	4.K	iv	vi	v	i	iii	ii	[2-3-1]	[3-2-1]	[3-1-2]	[1-2-3]	[2-1-3]	[1-3-2]
48	4.L	iv	vi	v	ii	i	iii	[2-3-1]	[3-2-1]	[3-1-2]	[1-3-2]	[1-2-3]	[2-1-3]
49	5.A	v	i	ii	vi	iii	iv	[3-1-2]	[1-2-3]	[1-3-2]	[3-2-1]	[2-1-3]	[2-3-1]
50	5.B	v	i	ii	vi	iv	iii	[3-1-2]	[1-2-3]	[1-3-2]	[3-2-1]	[2-3-1]	[2-1-3]
51	5.C	v	i	iii	ii	vi	iv	[3-1-2]	[1-2-3]	[2-1-3]	[1-3-2]	[3-2-1]	[2-3-1]
52	5.D	v	i	iv	iii	ii	vi	[3-1-2]	[1-2-3]	[2-3-1]	[2-1-3]	[1-3-2]	[3-2-1]
53	5.E	v	i	iv	vi	iii	ii	[3-1-2]	[1-2-3]	[2-3-1]	[3-2-1]	[2-1-3]	[1-3-2]
54	5.F	v	ii	i	iii	iv	vi	[3-1-2]	[1-3-2]	[1-2-3]	[2-1-3]	[2-3-1]	[3-2-1]
55	5.G	v	ii	i	iv	vi	iii	[3-1-2]	[1-3-2]	[1-2-3]	[2-3-1]	[3-2-1]	[2-1-3]
56	5.H	v	ii	vi	iii	i	iv	[3-1-2]	[1-3-2]	[3-2-1]	[2-1-3]	[1-2-3]	[2-3-1]
57	5.I	v	ii	vi	iv	iii	i	[3-1-2]	[1-3-2]	[3-2-1]	[2-3-1]	[2-1-3]	[1-2-3]
58	5.J	v	vi	iii	ii	i	iv	[3-1-2]	[3-2-1]	[2-1-3]	[1-3-2]	[1-2-3]	[2-3-1]
59	5.K	v	vi	iv	iii	i	ii	[3-1-2]	[3-2-1]	[2-3-1]	[2-1-3]	[1-2-3]	[1-3-2]
60	5.L	v	vi	iv	iii	ii	i	[3-1-2]	[3-2-1]	[2-3-1]	[2-1-3]	[1-3-2]	[1-2-3]
61	6.A	vi	iii	i	iv	v	ii	[3-2-1]	[2-1-3]	[1-2-3]	[2-3-1]	[3-1-2]	[1-3-2]
62	6.B	vi	iii	ii	i	iv	v	[3-2-1]	[2-1-3]	[1-3-2]	[1-2-3]	[2-3-1]	[3-1-2]
63	6.C	vi	iii	ii	v	i	iv	[3-2-1]	[2-1-3]	[1-3-2]	[3-1-2]	[1-2-3]	[2-3-1]
64	6.D	vi	iii	iv	v	i	ii	[3-2-1]	[2-1-3]	[2-3-1]	[3-1-2]	[1-2-3]	[1-3-2]
65	6.E	vi	iii	iv	v	ii	i	[3-2-1]	[2-1-3]	[2-3-1]	[3-1-2]	[1-3-2]	[1-2-3]
66	6.F	vi	iv	iii	i	ii	v	[3-2-1]	[2-3-1]	[2-1-3]	[1-2-3]	[1-3-2]	[3-1-2]
67	6.G	vi	iv	iii	ii	v	i	[3-2-1]	[2-3-1]	[2-1-3]	[1-3-2]	[3-1-2]	[1-2-3]
68	6.H	vi	iv	v	i	iii	ii	[3-2-1]	[2-3-1]	[3-1-2]	[1-2-3]	[2-1-3]	[1-3-2]
69	6.I	vi	iv	v	ii	i	iii	[3-2-1]	[2-3-1]	[3-1-2]	[1-3-2]	[1-2-3]	[2-1-3]
70	6.J	vi	v	i	iv	iii	ii	[3-2-1]	[3-1-2]	[1-2-3]	[2-3-1]	[2-1-3]	[1-3-2]
71	6.K	vi	v	ii	i	iii	iv	[3-2-1]	[3-1-2]	[1-3-2]	[1-2-3]	[2-1-3]	[2-3-1]
72	6.L	vi	v	ii	i	iv	iii	[3-2-1]	[3-1-2]	[1-3-2]	[1-2-3]	[2-3-1]	[2-1-3]

appendix three: The seventy-two sequences used in the construction of the solo viola series.

appendix four

piece	name	latin squares											
		permutations substituted						permutations given					
solo viola ascending (i)	1.A	i	ii	v	vi	iii	iv	[1-2-3]	[1-3-2]	[3-1-2]	[3-2-1]	[2-1-3]	[2-3-1]
	2.A	ii	i	iii	iv	v	vi	[1-3-2]	[1-2-3]	[2-1-3]	[2-3-1]	[3-1-2]	[3-2-1]
	3.K	iii	iv	vi	v	i	ii	[2-1-3]	[2-3-1]	[3-2-1]	[3-1-2]	[1-2-3]	[1-3-2]
	4.B	iv	iii	i	ii	vi	v	[2-3-1]	[2-1-3]	[1-2-3]	[1-3-2]	[3-2-1]	[3-1-2]
	5.L	v	vi	iv	iii	ii	i	[3-1-2]	[3-2-1]	[2-3-1]	[2-1-3]	[1-3-2]	[1-2-3]
	6.L	vi	v	ii	i	iv	iii	[3-2-1]	[3-1-2]	[1-3-2]	[1-2-3]	[2-3-1]	[2-1-3]
solo viola ascending (ii)	1.B	i	ii	v	vi	iv	iii	[1-2-3]	[1-3-2]	[3-1-2]	[3-2-1]	[2-3-1]	[2-1-3]
	2.B	ii	i	iii	iv	vi	v	[1-3-2]	[1-2-3]	[2-1-3]	[2-3-1]	[3-2-1]	[3-1-2]
	3.L	iii	iv	vi	v	ii	i	[2-1-3]	[2-3-1]	[3-2-1]	[3-1-2]	[1-3-2]	[1-2-3]
	4.A	iv	iii	i	ii	v	vi	[2-3-1]	[2-1-3]	[1-2-3]	[1-3-2]	[3-1-2]	[3-2-1]
	5.K	v	vi	iv	iii	i	ii	[3-1-2]	[3-2-1]	[2-3-1]	[2-1-3]	[1-2-3]	[1-3-2]
	6.K	vi	v	ii	i	iii	iv	[3-2-1]	[3-1-2]	[1-3-2]	[1-2-3]	[2-1-3]	[2-3-1]
solo viola ascending (iii)	1.C	i	ii	vi	iii	iv	v	[1-2-3]	[1-3-2]	[3-2-1]	[2-1-3]	[2-3-1]	[3-1-2]
	2.C	ii	i	iv	v	vi	iii	[1-3-2]	[1-2-3]	[2-3-1]	[3-1-2]	[3-2-1]	[2-1-3]
	3.J	iii	iv	v	i	ii	vi	[2-1-3]	[2-3-1]	[3-1-2]	[1-2-3]	[1-3-2]	[3-2-1]
	4.C	iv	iii	ii	vi	v	i	[2-3-1]	[2-1-3]	[1-3-2]	[3-2-1]	[3-1-2]	[1-2-3]
	5.J	v	vi	iii	ii	i	iv	[3-1-2]	[3-2-1]	[2-1-3]	[1-3-2]	[1-2-3]	[2-3-1]
	6.J	vi	v	i	iv	iii	ii	[3-2-1]	[3-1-2]	[1-2-3]	[2-3-1]	[2-1-3]	[1-3-2]
solo viola ascending (iv)	1.D	i	iii	ii	v	vi	iv	[1-2-3]	[2-1-3]	[1-3-2]	[3-1-2]	[3-2-1]	[2-3-1]
	2.D	ii	v	i	iii	iv	vi	[1-3-2]	[3-1-2]	[1-2-3]	[2-1-3]	[2-3-1]	[3-2-1]
	3.D	iii	i	iv	vi	v	ii	[2-1-3]	[1-2-3]	[2-3-1]	[3-2-1]	[3-1-2]	[1-3-2]
	4.I	iv	vi	iii	i	ii	v	[2-3-1]	[3-2-1]	[2-1-3]	[1-2-3]	[1-3-2]	[3-1-2]
	5.I	v	ii	vi	iv	iii	i	[3-1-2]	[1-3-2]	[3-2-1]	[2-3-1]	[2-1-3]	[1-2-3]
	6.I	vi	iv	v	ii	i	iii	[3-2-1]	[2-3-1]	[3-1-2]	[1-3-2]	[1-2-3]	[2-1-3]
solo viola ascending (v)	1.E	i	iii	ii	vi	iv	v	[1-2-3]	[2-1-3]	[1-3-2]	[3-2-1]	[2-3-1]	[3-1-2]
	2.E	ii	v	i	iv	vi	iii	[1-3-2]	[3-1-2]	[1-2-3]	[2-3-1]	[3-2-1]	[2-1-3]
	3.C	iii	i	iv	v	ii	vi	[2-1-3]	[1-2-3]	[2-3-1]	[3-1-2]	[1-3-2]	[3-2-1]
	4.J	iv	vi	iii	ii	v	i	[2-3-1]	[3-2-1]	[2-1-3]	[1-3-2]	[3-1-2]	[1-2-3]
	5.H	v	ii	vi	iii	i	iv	[3-1-2]	[1-3-2]	[3-2-1]	[2-1-3]	[1-2-3]	[2-3-1]
	6.H	vi	iv	v	i	iii	ii	[3-2-1]	[2-3-1]	[3-1-2]	[1-2-3]	[2-1-3]	[1-3-2]
solo viola ascending (vi)	1.F	i	iii	iv	v	ii	vi	[1-2-3]	[2-1-3]	[2-3-1]	[3-1-2]	[1-3-2]	[3-2-1]
	2.F	ii	v	vi	iii	i	iv	[1-3-2]	[3-1-2]	[3-2-1]	[2-1-3]	[1-2-3]	[2-3-1]
	3.B	iii	i	ii	vi	iv	v	[2-1-3]	[1-2-3]	[1-3-2]	[3-2-1]	[2-3-1]	[3-1-2]
	4.K	iv	vi	v	i	iii	ii	[2-3-1]	[3-2-1]	[3-1-2]	[2-1-3]	[2-3-1]	[1-3-2]
	5.G	v	ii	i	iv	vi	iii	[3-1-2]	[1-3-2]	[1-2-3]	[2-3-1]	[3-2-1]	[2-1-3]
	6.G	vi	iv	iii	ii	v	i	[3-2-1]	[2-3-1]	[2-1-3]	[1-3-2]	[3-1-2]	[1-2-3]
solo viola ascending (vii)	1.G	i	iii	iv	vi	v	ii	[1-2-3]	[2-1-3]	[2-3-1]	[3-2-1]	[3-1-2]	[1-3-2]
	2.G	ii	v	vi	iv	iii	i	[1-3-2]	[3-1-2]	[3-2-1]	[2-3-1]	[2-1-3]	[1-2-3]
	3.A	iii	i	ii	v	vi	iv	[2-1-3]	[1-2-3]	[1-3-2]	[3-1-2]	[3-2-1]	[2-3-1]
	4.L	iv	vi	v	ii	i	iii	[2-3-1]	[3-2-1]	[3-1-2]	[1-3-2]	[1-2-3]	[2-1-3]
	5.F	v	ii	i	iii	iv	vi	[3-1-2]	[1-3-2]	[1-2-3]	[2-1-3]	[2-3-1]	[3-2-1]
	6.F	vi	iv	iii	i	ii	v	[3-2-1]	[2-3-1]	[2-1-3]	[1-2-3]	[1-3-2]	[3-1-2]
solo viola ascending (viii)	1.H	i	iv	iii	ii	v	vi	[1-2-3]	[2-3-1]	[2-1-3]	[1-3-2]	[3-1-2]	[3-2-1]
	2.K	ii	vi	v	i	iii	iv	[1-3-2]	[3-2-1]	[3-1-2]	[1-2-3]	[2-1-3]	[2-3-1]
	3.F	iii	ii	i	iv	vi	v	[2-1-3]	[1-3-2]	[1-2-3]	[2-3-1]	[3-2-1]	[3-1-2]
	4.G	iv	v	vi	iii	i	ii	[2-3-1]	[3-1-2]	[3-2-1]	[2-1-3]	[1-2-3]	[1-3-2]
	5.B	v	i	ii	vi	iv	iii	[3-1-2]	[1-2-3]	[1-3-2]	[3-2-1]	[2-3-1]	[2-1-3]
	6.E	vi	iii	iv	v	ii	i	[3-2-1]	[2-1-3]	[2-3-1]	[3-1-2]	[1-3-2]	[1-2-3]
solo viola ascending (ix)	1.I	i	iv	iii	ii	vi	v	[1-2-3]	[2-3-1]	[2-1-3]	[1-3-2]	[3-2-1]	[3-1-2]
	2.L	ii	vi	v	i	iv	iii	[1-3-2]	[3-2-1]	[3-1-2]	[1-2-3]	[2-3-1]	[2-1-3]
	3.E	iii	ii	i	iv	v	vi	[2-1-3]	[1-3-2]	[1-2-3]	[2-3-1]	[3-1-2]	[3-2-1]
	4.H	iv	v	vi	iii	ii	i	[2-3-1]	[3-1-2]	[3-2-1]	[2-1-3]	[1-3-2]	[1-2-3]
	5.A	v	i	ii	vi	iii	iv	[3-1-2]	[1-2-3]	[1-3-2]	[3-2-1]	[2-1-3]	[2-3-1]
	6.D	vi	iii	iv	v	i	ii	[3-2-1]	[2-1-3]	[2-3-1]	[3-1-2]	[1-2-3]	[1-3-2]
solo viola ascending (x)	1.J	i	iv	v	ii	vi	iii	[1-2-3]	[2-3-1]	[3-1-2]	[1-3-2]	[3-2-1]	[2-1-3]
	2.H	ii	vi	iii	i	iv	v	[1-3-2]	[3-2-1]	[2-1-3]	[1-2-3]	[2-3-1]	[3-1-2]
	3.H	iii	ii	vi	iv	v	i	[2-1-3]	[1-3-2]	[3-2-1]	[2-3-1]	[3-1-2]	[1-2-3]
	4.E	iv	v	i	iii	ii	vi	[2-3-1]	[3-1-2]	[1-2-3]	[2-1-3]	[1-3-2]	[3-2-1]
	5.E	v	i	iv	vi	iii	ii	[3-1-2]	[1-2-3]	[2-3-1]	[3-2-1]	[2-1-3]	[1-3-2]
	6.C	vi	iii	ii	v	i	iv	[3-2-1]	[2-1-3]	[1-3-2]	[3-1-2]	[1-2-3]	[2-3-1]
solo viola ascending (xi)	1.K	i	iv	v	vi	iii	ii	[1-2-3]	[2-3-1]	[3-1-2]	[3-2-1]	[2-1-3]	[1-3-2]
	2.I	ii	vi	iii	iv	v	i	[1-3-2]	[3-2-1]	[2-1-3]	[2-3-1]	[3-1-2]	[1-2-3]
	3.I	iii	ii	vi	v	i	iv	[2-1-3]	[1-3-2]	[3-2-1]	[3-1-2]	[1-2-3]	[2-3-1]
	4.D	iv	v	i	ii	vi	iii	[2-3-1]	[3-1-2]	[1-2-3]	[1-3-2]	[3-2-1]	[2-1-3]
	5.D	v	i	iv	iii	ii	vi	[3-1-2]	[1-2-3]	[2-3-1]	[2-1-3]	[1-3-2]	[3-2-1]
	6.B	vi	iii	ii	i	iv	v	[3-2-1]	[2-1-3]	[1-3-2]	[1-2-3]	[2-3-1]	[3-1-2]
solo viola ascending (xii)	1.L	i	iv	vi	iii	ii	v	[1-2-3]	[2-3-1]	[3-2-1]	[2-1-3]	[1-3-2]	[3-1-2]
	2.J	ii	vi	iv	v	i	iii	[1-3-2]	[3-2-1]	[2-3-1]	[3-1-2]	[1-2-3]	[2-1-3]
	3.G	iii	ii	v	i	iv	vi	[2-1-3]	[1-3-2]	[3-1-2]	[1-2-3]	[2-3-1]	[3-2-1]
	4.F	iv	v	ii	vi	iii	i	[2-3-1]	[3-1-2]	[1-3-2]	[3-2-1]	[2-1-3]	[1-2-3]
	5.C	v	i	iii	ii	vi	iv	[3-1-2]	[1-2-3]	[2-1-3]	[1-3-2]	[3-2-1]	[2-3-1]
	6.A	vi	iii	i	iv	v	ii	[3-2-1]	[2-1-3]	[1-2-3]	[2-3-1]	[3-1-2]	[1-3-2]

appendix four: The Latin Square arrangements used within solo viola ascending (i-xii).

appendix five

piece	name	latin squares											
		permutations substituted						permutations given					
solo viola descending (i)	6.L	vi	v	ii	i	iv	iii	[3-2-1]	[3-1-2]	[1-3-2]	[1-2-3]	[2-3-1]	[2-1-3]
	5.L	v	vi	iv	iii	ii	i	[3-1-2]	[3-2-1]	[2-3-1]	[2-1-3]	[1-3-2]	[1-2-3]
	4.B	iv	iii	i	ii	vi	v	[2-3-1]	[2-1-3]	[1-2-3]	[1-3-2]	[3-2-1]	[3-1-2]
	3.K	iii	iv	vi	v	i	ii	[2-1-3]	[2-3-1]	[3-2-1]	[3-1-2]	[1-2-3]	[1-3-2]
	2.A	ii	i	iii	iv	v	vi	[1-3-2]	[1-2-3]	[2-1-3]	[2-3-1]	[3-1-2]	[3-2-1]
	1.A	i	ii	v	vi	iii	iv	[1-2-3]	[1-3-2]	[3-1-2]	[3-2-1]	[2-1-3]	[2-3-1]
solo viola descending (ii)	6.K	vi	v	ii	i	iii	iv	[3-2-1]	[3-1-2]	[1-3-2]	[1-2-3]	[2-1-3]	[2-3-1]
	5.K	v	vi	iv	iii	i	ii	[3-1-2]	[3-2-1]	[2-3-1]	[2-1-3]	[1-2-3]	[1-3-2]
	4.A	iv	iii	i	ii	v	vi	[2-3-1]	[2-1-3]	[1-2-3]	[1-3-2]	[3-1-2]	[3-2-1]
	3.L	iii	iv	vi	v	ii	i	[2-1-3]	[2-3-1]	[3-2-1]	[3-1-2]	[1-3-2]	[1-2-3]
	2.B	ii	i	iii	iv	vi	v	[1-3-2]	[1-2-3]	[2-1-3]	[2-3-1]	[3-2-1]	[3-1-2]
	1.B	i	ii	v	vi	iv	iii	[1-2-3]	[1-3-2]	[3-1-2]	[3-2-1]	[2-3-1]	[2-1-3]
solo viola descending (iii)	6.J	vi	v	i	iv	iii	ii	[3-2-1]	[3-1-2]	[1-2-3]	[2-3-1]	[2-1-3]	[1-3-2]
	5.J	v	vi	iii	ii	i	iv	[3-1-2]	[3-2-1]	[2-1-3]	[1-3-2]	[1-2-3]	[2-3-1]
	4.C	iv	iii	ii	vi	v	i	[2-3-1]	[2-1-3]	[1-3-2]	[3-2-1]	[3-1-2]	[1-2-3]
	3.J	iii	iv	v	i	ii	vi	[2-1-3]	[2-3-1]	[3-1-2]	[1-2-3]	[1-3-2]	[3-2-1]
	2.C	ii	i	iv	v	vi	iii	[1-3-2]	[1-2-3]	[2-3-1]	[3-1-2]	[3-2-1]	[2-1-3]
	1.C	i	ii	vi	iii	iv	v	[1-2-3]	[1-3-2]	[3-2-1]	[2-1-3]	[2-3-1]	[3-1-2]
solo viola descending (iv)	6.I	vi	iv	v	ii	i	iii	[3-2-1]	[2-3-1]	[3-1-2]	[1-3-2]	[1-2-3]	[2-1-3]
	5.I	v	ii	vi	iv	iii	i	[3-1-2]	[1-3-2]	[3-2-1]	[2-3-1]	[2-1-3]	[1-2-3]
	4.I	iv	vi	iii	i	ii	v	[2-3-1]	[3-2-1]	[2-1-3]	[1-2-3]	[1-3-2]	[3-1-2]
	3.D	iii	i	iv	vi	v	ii	[2-1-3]	[1-2-3]	[2-3-1]	[3-2-1]	[3-1-2]	[1-3-2]
	2.D	ii	v	i	iii	iv	vi	[1-3-2]	[3-1-2]	[1-2-3]	[2-1-3]	[2-3-1]	[3-2-1]
	1.D	i	iii	ii	v	vi	iv	[1-2-3]	[2-1-3]	[1-3-2]	[3-1-2]	[3-2-1]	[2-3-1]
solo viola descending (v)	6.H	vi	iv	v	i	iii	ii	[3-2-1]	[2-3-1]	[3-1-2]	[1-2-3]	[2-1-3]	[1-3-2]
	5.H	v	ii	vi	iii	i	iv	[3-1-2]	[1-3-2]	[3-2-1]	[2-1-3]	[1-2-3]	[2-3-1]
	4.J	iv	vi	iii	ii	v	i	[2-3-1]	[3-2-1]	[2-1-3]	[1-3-2]	[3-1-2]	[1-2-3]
	3.C	iii	i	iv	v	ii	vi	[2-1-3]	[1-2-3]	[2-3-1]	[3-1-2]	[1-3-2]	[3-2-1]
	2.E	ii	v	i	iv	vi	iii	[1-3-2]	[3-1-2]	[1-2-3]	[2-3-1]	[3-2-1]	[2-1-3]
	1.E	i	iii	ii	vi	iv	v	[1-2-3]	[2-1-3]	[1-3-2]	[3-2-1]	[2-3-1]	[3-1-2]
solo viola descending (vi)	6.G	vi	iv	iii	ii	v	i	[3-2-1]	[2-3-1]	[2-1-3]	[1-3-2]	[3-1-2]	[1-2-3]
	5.G	v	ii	i	iv	vi	iii	[3-1-2]	[1-3-2]	[1-2-3]	[2-3-1]	[3-2-1]	[2-1-3]
	4.K	iv	vi	v	i	iii	ii	[2-3-1]	[3-2-1]	[3-1-2]	[1-2-3]	[2-1-3]	[1-3-2]
	3.B	iii	i	ii	vi	iv	v	[2-1-3]	[1-2-3]	[1-3-2]	[3-2-1]	[2-3-1]	[3-1-2]
	2.F	ii	v	vi	iii	i	iv	[1-3-2]	[3-1-2]	[3-2-1]	[2-1-3]	[1-2-3]	[2-3-1]
	1.F	i	iii	iv	v	ii	vi	[1-2-3]	[2-1-3]	[2-3-1]	[3-1-2]	[1-3-2]	[3-2-1]
solo viola descending (vii)	6.F	vi	iv	iii	i	ii	v	[3-2-1]	[2-3-1]	[2-1-3]	[1-2-3]	[1-3-2]	[3-1-2]
	5.F	v	ii	i	iii	iv	vi	[3-1-2]	[1-3-2]	[1-2-3]	[2-1-3]	[2-3-1]	[3-2-1]
	4.L	iv	vi	v	ii	i	iii	[2-3-1]	[3-2-1]	[3-1-2]	[1-3-2]	[1-2-3]	[2-1-3]
	3.A	iii	i	ii	v	vi	iv	[2-1-3]	[1-2-3]	[1-3-2]	[3-1-2]	[3-2-1]	[2-3-1]
	2.G	ii	v	vi	iv	iii	i	[1-3-2]	[3-1-2]	[3-2-1]	[2-3-1]	[2-1-3]	[1-2-3]
	1.G	i	iii	iv	vi	v	ii	[1-2-3]	[2-1-3]	[2-3-1]	[3-2-1]	[3-1-2]	[1-3-2]
solo viola descending (viii)	6.E	vi	iii	iv	v	ii	i	[3-2-1]	[2-1-3]	[2-3-1]	[3-1-2]	[1-3-2]	[1-2-3]
	5.B	v	i	ii	vi	iv	iii	[3-1-2]	[1-2-3]	[1-3-2]	[3-2-1]	[2-3-1]	[2-1-3]
	4.G	iv	v	vi	iii	i	ii	[2-3-1]	[3-1-2]	[3-2-1]	[2-1-3]	[1-2-3]	[1-3-2]
	3.F	iii	ii	i	iv	vi	v	[2-1-3]	[1-3-2]	[1-2-3]	[2-3-1]	[3-2-1]	[3-1-2]
	2.K	ii	vi	v	i	iii	iv	[1-3-2]	[3-2-1]	[3-1-2]	[1-2-3]	[2-1-3]	[2-3-1]
	1.H	i	iv	iii	ii	v	vi	[1-2-3]	[2-3-1]	[2-1-3]	[1-3-2]	[3-1-2]	[3-2-1]
solo viola descending (ix)	6.D	vi	iii	iv	v	i	ii	[3-2-1]	[2-1-3]	[2-3-1]	[3-1-2]	[1-2-3]	[1-3-2]
	5.A	v	i	ii	vi	iii	iv	[3-1-2]	[1-2-3]	[1-3-2]	[3-2-1]	[2-1-3]	[2-3-1]
	4.H	iv	v	vi	iii	ii	i	[2-3-1]	[3-1-2]	[3-2-1]	[2-1-3]	[1-3-2]	[1-2-3]
	3.E	iii	ii	i	iv	v	vi	[2-1-3]	[1-3-2]	[1-2-3]	[2-3-1]	[3-1-2]	[3-2-1]
	2.L	ii	vi	v	i	iv	iii	[1-3-2]	[3-2-1]	[3-1-2]	[1-2-3]	[2-3-1]	[2-1-3]
	1.I	i	iv	iii	ii	vi	v	[1-2-3]	[2-3-1]	[2-1-3]	[1-3-2]	[3-2-1]	[3-1-2]
solo viola descending (x)	6.C	vi	iii	ii	v	i	iv	[3-2-1]	[2-1-3]	[1-3-2]	[3-1-2]	[1-2-3]	[2-3-1]
	5.E	v	i	iv	vi	iii	ii	[3-1-2]	[1-2-3]	[2-3-1]	[3-2-1]	[2-1-3]	[1-3-2]
	4.E	iv	v	i	iii	ii	vi	[2-3-1]	[3-1-2]	[1-2-3]	[2-1-3]	[1-3-2]	[3-2-1]
	3.H	iii	ii	vi	iv	v	i	[2-1-3]	[1-3-2]	[3-2-1]	[2-3-1]	[3-1-2]	[1-2-3]
	2.H	ii	vi	iii	i	iv	v	[1-3-2]	[3-2-1]	[2-1-3]	[1-2-3]	[2-3-1]	[3-1-2]
	1.J	i	iv	v	ii	vi	iii	[1-2-3]	[2-3-1]	[3-1-2]	[1-3-2]	[3-2-1]	[2-1-3]
solo viola descending (xi)	6.B	vi	iii	ii	i	iv	v	[3-2-1]	[2-1-3]	[1-3-2]	[1-2-3]	[2-3-1]	[3-1-2]
	5.D	v	i	iv	iii	ii	vi	[3-1-2]	[1-2-3]	[2-3-1]	[2-1-3]	[1-3-2]	[3-2-1]
	4.D	iv	v	i	ii	vi	iii	[2-3-1]	[3-1-2]	[1-2-3]	[1-3-2]	[3-2-1]	[2-1-3]
	3.I	iii	ii	vi	v	i	iv	[2-1-3]	[1-3-2]	[3-2-1]	[3-1-2]	[1-2-3]	[2-3-1]
	2.I	ii	vi	iii	iv	v	i	[1-3-2]	[3-2-1]	[2-1-3]	[2-3-1]	[3-1-2]	[1-2-3]
	1.K	i	iv	v	vi	iii	ii	[1-2-3]	[2-3-1]	[3-1-2]	[3-2-1]	[2-1-3]	[1-3-2]
solo viola descending (xii)	6.A	vi	iii	i	iv	v	ii	[3-2-1]	[2-1-3]	[1-2-3]	[2-3-1]	[3-1-2]	[1-3-2]
	5.C	v	i	iii	ii	vi	iv	[3-1-2]	[1-2-3]	[2-1-3]	[1-3-2]	[3-2-1]	[2-3-1]
	4.F	iv	v	ii	vi	iii	i	[2-3-1]	[3-1-2]	[1-3-2]	[3-2-1]	[1-2-3]	[1-2-3]
	3.G	iii	ii	v	i	iv	vi	[2-1-3]	[1-3-2]	[3-1-2]	[1-2-3]	[2-3-1]	[3-2-1]
	2.J	ii	vi	iv	v	i	iii	[1-3-2]	[3-2-1]	[2-3-1]	[3-1-2]	[1-2-3]	[2-1-3]
	1.L	i	iv	vi	iii	ii	v	[1-2-3]	[2-3-1]	[3-2-1]	[2-1-3]	[1-3-2]	[3-1-2]

appendix five: The Latin Square arrangements used within solo viola descending (i-xii).

figure no.	chord	voicing no.	permutation	substitution				chord voicing			
								B	T	A	S
1	Cb Major 9th	1	[1-2-3-4]	Root	Third	Fifth	Ninth	Cb	Eb	Gb	Db
2	Gb Major 9th	2	[1-2-4-3]	Root	Third	Ninth	Fifth	Gb	Bb	Ab	Db
3	Cb Major 9th	3	[1-3-2-4]	Root	Fifth	Third	Ninth	Cb	Gb	Eb	Db
4	Gb Major 9th	4	[1-3-4-2]	Root	Fifth	Ninth	Third	Gb	Db	Ab	Bb
5	Cb Major 9th	5	[1-4-2-3]	Root	Ninth	Third	Fifth	Cb	Db	Eb	Gb
6	Gb Major 9th	6	[1-4-3-2]	Root	Ninth	Fifth	Third	Gb	Ab	Db	Bb
7	Cb Major 9th	7	[2-1-3-4]	Third	Root	Fifth	Ninth	Eb	Cb	Gb	Db
8	Gb Major 9th	8	[2-1-4-3]	Third	Root	Ninth	Fifth	Bb	Gb	Ab	Db
9	Cb Major 9th	9	[2-3-1-4]	Third	Fifth	Root	Ninth	Eb	Gb	Cb	Db
10	Gb Major 9th	10	[2-3-4-1]	Third	Fifth	Ninth	Root	Bb	Db	Ab	Gb
11	Cb Major 9th	11	[2-4-1-3]	Third	Ninth	Root	Fifth	Eb	Db	Cb	Gb
12	Gb Major 9th	12	[2-4-3-1]	Third	Ninth	Fifth	Root	Bb	Ab	Db	Gb
13	Cb Major 9th	13	[3-1-2-4]	Fifth	Root	Third	Ninth	Gb	Cb	Eb	Db
14	Gb Major 9th	14	[3-1-4-2]	Fifth	Root	Ninth	Third	Db	Gb	Ab	Bb
15	Cb Major 9th	15	[3-2-1-4]	Fifth	Third	Root	Ninth	Gb	Eb	Cb	Db
16	Gb Major 9th	16	[3-2-4-1]	Fifth	Third	Ninth	Root	Db	Bb	Ab	Gb
17	Cb Major 9th	17	[3-4-1-2]	Fifth	Ninth	Root	Third	Gb	Db	Cb	Eb
18	Gb Major 9th	18	[3-4-2-1]	Fifth	Ninth	Third	Root	Db	Ab	Bb	Gb
19	Cb Major 9th	19	[4-1-2-3]	Ninth	Root	Third	Fifth	Db	Cb	Eb	Gb
20	Gb Major 9th	20	[4-1-3-2]	Ninth	Root	Fifth	Third	Ab	Gb	Db	Bb
21	Cb Major 9th	21	[4-2-1-3]	Ninth	Third	Root	Fifth	Db	Eb	Cb	Gb
22	Gb Major 9th	22	[4-2-3-1]	Ninth	Third	Fifth	Root	Ab	Bb	Db	Gb
23	Cb Major 9th	23	[4-3-1-2]	Ninth	Fifth	Root	Third	Db	Gb	Cb	Eb
24	Gb Major 9th	24	[4-3-2-1]	Ninth	Fifth	Third	Root	Ab	Db	Bb	Gb
25	Cb Major 9th	24	[4-3-2-1]	Ninth	Fifth	Third	Root	Db	Gb	Eb	Cb
26	Gb Major 9th	23	[4-3-1-2]	Ninth	Fifth	Root	Third	Ab	Db	Gb	Bb
27	Cb Major 9th	22	[4-2-3-1]	Ninth	Third	Fifth	Root	Db	Eb	Gb	Cb
28	Gb Major 9th	21	[4-2-1-3]	Ninth	Third	Root	Fifth	Ab	Bb	Gb	Db
29	Cb Major 9th	20	[4-1-3-2]	Ninth	Root	Fifth	Third	Db	Cb	Gb	Eb
30	Gb Major 9th	19	[4-1-2-3]	Ninth	Root	Third	Fifth	Ab	Gb	Bb	Db
31	Cb Major 9th	18	[3-4-2-1]	Fifth	Ninth	Third	Root	Gb	Db	Eb	Cb
32	Gb Major 9th	17	[3-4-1-2]	Fifth	Ninth	Root	Third	Db	Ab	Gb	Bb
33	Cb Major 9th	16	[3-2-4-1]	Fifth	Third	Ninth	Root	Gb	Eb	Db	Cb
34	Gb Major 9th	15	[3-2-1-4]	Fifth	Third	Root	Ninth	Db	Bb	Gb	Ab
35	Cb Major 9th	14	[3-1-4-2]	Fifth	Root	Ninth	Third	Gb	Cb	Db	Eb
36	Gb Major 9th	13	[3-1-2-4]	Fifth	Root	Third	Ninth	Db	Gb	Bb	Ab
37	Cb Major 9th	12	[2-4-3-1]	Third	Ninth	Fifth	Root	Eb	Db	Gb	Cb
38	Gb Major 9th	11	[2-4-1-3]	Third	Ninth	Root	Fifth	Bb	Ab	Gb	Db
39	Cb Major 9th	10	[2-3-4-1]	Third	Fifth	Ninth	Root	Eb	Gb	Db	Cb
40	Gb Major 9th	9	[2-3-1-4]	Third	Fifth	Root	Ninth	Bb	Db	Gb	Ab
41	Cb Major 9th	8	[2-1-4-3]	Third	Root	Ninth	Fifth	Eb	Cb	Db	Gb
42	Gb Major 9th	7	[2-1-3-4]	Third	Root	Fifth	Ninth	Bb	Gb	Db	Ab
43	Cb Major 9th	6	[1-4-3-2]	Root	Ninth	Fifth	Third	Cb	Db	Gb	Eb
44	Gb Major 9th	5	[1-4-2-3]	Root	Ninth	Third	Fifth	Gb	Ab	Bb	Db
45	Cb Major 9th	4	[1-3-4-2]	Root	Fifth	Ninth	Third	Cb	Gb	Db	Eb
46	Gb Major 9th	3	[1-3-2-4]	Root	Fifth	Third	Ninth	Gb	Db	Bb	Ab
47	Cb Major 9th	2	[1-2-4-3]	Root	Third	Ninth	Fifth	Cb	Eb	Db	Gb
48	Gb Major 9th	1	[1-2-3-4]	Root	Third	Fifth	Ninth	Gb	Bb	Db	Ab

appendix seven

figure no.	chord	voicing no.	permutation	substitution				chord voicing			
								B	T	A	S
1	Cb Major 9th	24	[4-3-2-1]	Ninth	Fifth	Third	Root	Db	Gb	Eb	Cb
2	Gb Major 9th	23	[4-3-1-2]	Ninth	Fifth	Root	Third	Ab	Db	Gb	Bb
3	Cb Major 9th	22	[4-2-3-1]	Ninth	Third	Fifth	Root	Db	Eb	Gb	Cb
4	Gb Major 9th	21	[4-2-1-3]	Ninth	Third	Root	Fifth	Ab	Bb	Gb	Db
5	Cb Major 9th	20	[4-1-3-2]	Ninth	Root	Fifth	Third	Db	Cb	Gb	Eb
6	Gb Major 9th	19	[4-1-2-3]	Ninth	Root	Third	Fifth	Ab	Gb	Bb	Db
7	Cb Major 9th	18	[3-4-2-1]	Fifth	Ninth	Third	Root	Gb	Db	Eb	Cb
8	Gb Major 9th	17	[3-4-1-2]	Fifth	Ninth	Root	Third	Db	Ab	Gb	Bb
9	Cb Major 9th	16	[3-2-4-1]	Fifth	Third	Ninth	Root	Gb	Eb	Db	Cb
10	Gb Major 9th	15	[3-2-1-4]	Fifth	Third	Root	Ninth	Db	Bb	Gb	Ab
11	Cb Major 9th	14	[3-1-4-2]	Fifth	Root	Ninth	Third	Gb	Cb	Db	Eb
12	Gb Major 9th	13	[3-1-2-4]	Fifth	Root	Third	Ninth	Db	Gb	Bb	Ab
13	Cb Major 9th	12	[2-4-3-1]	Third	Ninth	Fifth	Root	Eb	Db	Gb	Cb
14	Gb Major 9th	11	[2-4-1-3]	Third	Ninth	Root	Fifth	Bb	Ab	Gb	Db
15	Cb Major 9th	10	[2-3-4-1]	Third	Fifth	Ninth	Root	Eb	Gb	Db	Cb
16	Gb Major 9th	9	[2-3-1-4]	Third	Fifth	Root	Ninth	Bb	Db	Gb	Ab
17	Cb Major 9th	8	[2-1-4-3]	Third	Root	Ninth	Fifth	Eb	Cb	Db	Gb
18	Gb Major 9th	7	[2-1-3-4]	Third	Root	Fifth	Ninth	Bb	Gb	Db	Ab
19	Cb Major 9th	6	[1-4-3-2]	Root	Ninth	Fifth	Third	Cb	Db	Gb	Eb
20	Gb Major 9th	5	[1-4-2-3]	Root	Ninth	Third	Fifth	Gb	Ab	Bb	Db
21	Cb Major 9th	4	[1-3-4-2]	Root	Fifth	Ninth	Third	Cb	Gb	Db	Eb
22	Gb Major 9th	3	[1-3-2-4]	Root	Fifth	Third	Ninth	Gb	Db	Bb	Ab
23	Cb Major 9th	2	[1-2-4-3]	Root	Third	Ninth	Fifth	Cb	Eb	Db	Gb
24	Gb Major 9th	1	[1-2-3-4]	Root	Third	Fifth	Ninth	Gb	Bb	Db	Ab
25	Cb Major 9th	1	[1-2-3-4]	Root	Third	Fifth	Ninth	Cb	Eb	Gb	Db
26	Gb Major 9th	2	[1-2-4-3]	Root	Third	Ninth	Fifth	Gb	Bb	Ab	Db
27	Cb Major 9th	3	[1-3-2-4]	Root	Fifth	Third	Ninth	Cb	Gb	Eb	Db
28	Gb Major 9th	4	[1-3-4-2]	Root	Fifth	Ninth	Third	Gb	Db	Ab	Bb
29	Cb Major 9th	5	[1-4-2-3]	Root	Ninth	Third	Fifth	Cb	Db	Eb	Gb
30	Gb Major 9th	6	[1-4-3-2]	Root	Ninth	Fifth	Third	Gb	Ab	Db	Bb
31	Cb Major 9th	7	[2-1-3-4]	Third	Root	Fifth	Ninth	Eb	Cb	Gb	Db
32	Gb Major 9th	8	[2-1-4-3]	Third	Root	Ninth	Fifth	Bb	Gb	Ab	Db
33	Cb Major 9th	9	[2-3-1-4]	Third	Fifth	Root	Ninth	Eb	Gb	Cb	Db
34	Gb Major 9th	10	[2-3-4-1]	Third	Fifth	Ninth	Root	Bb	Db	Ab	Gb
35	Cb Major 9th	11	[2-4-1-3]	Third	Ninth	Root	Fifth	Eb	Db	Cb	Gb
36	Gb Major 9th	12	[2-4-3-1]	Third	Ninth	Fifth	Root	Bb	Ab	Db	Gb
37	Cb Major 9th	13	[3-1-2-4]	Fifth	Root	Third	Ninth	Gb	Cb	Eb	Db
38	Gb Major 9th	14	[3-1-4-2]	Fifth	Root	Ninth	Third	Db	Gb	Ab	Bb
39	Cb Major 9th	15	[3-2-1-4]	Fifth	Third	Root	Ninth	Gb	Eb	Cb	Db
40	Gb Major 9th	16	[3-2-4-1]	Fifth	Third	Ninth	Root	Db	Bb	Ab	Gb
41	Cb Major 9th	17	[3-4-1-2]	Fifth	Ninth	Root	Third	Gb	Db	Cb	Eb
42	Gb Major 9th	18	[3-4-2-1]	Fifth	Ninth	Third	Root	Db	Ab	Bb	Gb
43	Cb Major 9th	19	[4-1-2-3]	Ninth	Root	Third	Fifth	Db	Cb	Eb	Gb
44	Gb Major 9th	20	[4-1-3-2]	Ninth	Root	Fifth	Third	Ab	Gb	Db	Bb
45	Cb Major 9th	21	[4-2-1-3]	Ninth	Third	Root	Fifth	Db	Eb	Cb	Gb
46	Gb Major 9th	22	[4-2-3-1]	Ninth	Third	Fifth	Root	Ab	Bb	Db	Gb
47	Cb Major 9th	23	[4-3-1-2]	Ninth	Fifth	Root	Third	Db	Gb	Cb	Eb
48	Gb Major 9th	24	[4-3-2-1]	Ninth	Fifth	Third	Root	Ab	Db	Bb	Gb

appendix eight

A#	B	A	C	A#	B	C#	C	B	C	C#	D	C#	D#	D	D#	D	E	E	F	D#	F#	E	F
G#	F#	G	A	G#	G	G#	A	A#	A	B	A#	B	A#	C	C	C#	B	D	C	C#	D#	D	C#
F	E	D#	E	F	F#	F	G	F#	G	F#	G#	G#	A	G	A#	G#	A	B	A#	A	A#	B	C
C	C#	D	C#	D#	D	D#	D	E	E	F	D#	F#	E	F	G	F#	F	F#	G	G#	G	A	G#

D	C	C#	D	D#	C#	D#	D	E	D#	F	E	E	F	F#	G	F#	F	G#	F#	G	G#	A	G
E	F	D#	F	E	F#	F	G	F#	F#	G	G#	A	G#	G	A#	G#	A	A#	B	A	B	A#	C
G	F#	G#	G	A	G#	G#	A	A#	B	A#	A	C	A#	B	C	C#	B	C#	C	D	C#	D#	D
A	B	A#	A#	B	C	C#	C	B	D	C	C#	D	D#	C#	D#	D	E	D#	F	E	E	F	F#

B	A#	A	A#	B	C	B	C#	C	C#	C	D	D	D#	C#	E	D	D#	F	E	D#	E	F	F#
F#	G	G#	G	A	G#	A	G#	A#	A#	B	A	C	A#	B	C#	C	B	C	C#	D	C#	D#	D
D#	F	E	F	E	F#	F#	G	F	G#	F#	G	A	G#	G	G#	A	A#	A	B	A#	B	A#	C
C#	C	D	D	D#	C#	E	D	D#	F	E	D#	E	F	F#	F	G	F#	G	F#	G#	G#	A	G

C#	C	D	C#	D#	D	D	D#	E	F	E	D#	F#	E	F	F#	G	F	G	F#	G#	G	A	G#
D#	F	E	E	F	F#	G	F#	F	G#	F#	G	G#	A	G	A	G#	A#	A	B	A#	A#	B	C
F#	G	G#	A	G#	G	A#	G#	A	A#	B	A	B	A#	C	B	C#	C	C	C#	D	D#	D	C#
B	A#	A	C	A#	B	C	C#	B	C#	C	D	C#	D#	D	D	D#	E	F	E	D#	F#	E	F

appendix eight: The template used in the construction of sixteen lines ascending.

appendix eight (continued)

G	F#	F	F#	G	G#	G	A	G#	A	G#	A#	A	A#	G#	A	G	G#	G#	G	F#	F	F#	G
D	D#	E	D#	F	E	F	E	F#	F#	G	F	G	F	F#	F#	F	E	D#	E	F	D	E	D#
B	C#	C	C#	C	D	D	D#	C#	E	D	D#	E	D#	D	C#	D	D#	C	D	C#	C	B	C#
A	G#	A#	A#	B	A	C	A#	B	C#	C	B	B	C	C#	A#	C	B	A#	A	B	A	A#	G#
A	G#	A#	A	B	A#	A#	B	C	C#	C	B	C#	B	C	B	C	A#	A#	A	B	G#	A#	A
B	C#	C	C	C#	D	D#	D	C#	E	D	D#	D#	E	D	D	C#	D#	C	D	C#	B	C	C#
D	D#	E	F	E	D#	F#	E	F	F#	G	F	F#	F	G	E	F#	F	D#	E	F	E	D#	D
G	F#	F	G#	F#	G	G#	A	G	A	G#	A#	G#	A#	A	G	G#	A	G#	G	F#	G	F	F#
F	G	F#	G	F#	G#	G#	A	G	A#	G#	A	A#	A	G#	G	G#	A	F#	G#	G	F#	F	G
D#	D	E	E	F	D#	F#	E	F	G	F#	F	F	F#	G	E	F#	F	E	D#	F	D#	E	D
C	C#	B	D	C	C#	D#	D	C#	D	D#	E	D	E	D#	D	C#	D#	C#	D	C	C#	B	C
A#	G#	A	B	A#	A	A#	B	C	B	C#	C	C	B	C#	B	C	A#	B	A	A#	A#	A	G#
G#	A	A#	B	A#	A	C	A#	B	C	C#	B	C	B	C#	A#	C	B	A	A#	B	A#	A	G#
C#	C	B	D	C	C#	D	D#	C#	D#	D	E	D	E	D#	C#	D	D#	D	C#	C	C#	B	C
E	D	D#	E	F	D#	F	E	F#	F	G	F#	F	F#	G	F#	F	E	F	D#	E	D#	E	D
F#	G	F	G	F#	G#	G	A	G#	G#	A	A#	A#	A	G#	A	G	G#	G	G#	F#	F#	F	G

appendix eight (continued): The template used in the construction of *sixteen lines ascending* (continued).

appendix eight (continued)

E	F#	F	E	D#	F	D#	E	D	D#	C#	D	D	C#	C	B	C	C#	A#	C	B	A#	A	B
D	C#	D#	C#	D	C	C#	B	C	C	B	A#	A	A#	B	G#	A#	A	G#	G	A	G	G#	F#
B	C	A#	B	A	A#	A#	A	G#	G	G#	A	F#	G#	G	F#	F	G	F	F#	E	F	D#	E
A	G	G#	G#	G	F#	F	F#	G	E	F#	F	E	D#	F	D#	E	D	D#	C#	D	D	C#	C
G	G#	A	G#	G	F#	G	F	F#	F	F#	E	E	D#	F	D	E	D#	C#	D	D#	D	C#	C
C	B	A#	B	A	A#	A	A#	G#	G#	G	A	F#	G#	G	F	F#	G	F#	F	E	F	D#	E
D#	C#	D	C#	D	C	C	B	C#	A#	C	B	A	A#	B	A#	A	G#	A	G	G#	G	G#	F#
F	F#	E	E	D#	F	D	E	D#	C#	D	D#	D	C#	C	C#	B	C	B	C	A#	A#	A	B
F	F#	E	F	D#	E	E	D#	D	C#	D	D#	C	D	C#	C	B	C#	B	C	A#	B	A	A#
D#	C#	D	D	C#	C	B	C	C#	A#	C	B	A#	A	B	A	A#	G#	A	G	G#	G#	G	F#
C	B	A#	A	A#	B	G#	A#	A	G#	G	A	G	G#	F#	G	F	F#	F#	F	E	D#	E	F
G	G#	A	F#	G#	G	F#	F	G	F	F#	E	F	D#	E	E	D#	D	C#	D	D#	C	D	C#
A	G	G#	G	G#	F#	F#	F	G	E	F#	F	D#	E	F	E	D#	D	D#	C#	D	C#	D	C
B	C	A#	A#	A	B	G#	A#	A	G	G#	A	G#	G	F#	G	F	F#	F	F#	E	E	D#	F
D	C#	D#	C	D	C#	B	C	C#	C	B	A#	B	A	A#	A	A#	G#	G#	G	A	F#	G#	G
E	F#	F	D#	E	F	E	D#	D	D#	C#	D	C#	D	C	C	B	C#	A#	C	B	A	A#	B

appendix eight (continued): The template used in the construction of *sixteen lines ascending* (continued).

appendix eight (continued)

C	B	C#	A#	C	B	A	A#	B	A#	A	G#	A	G	G#	G	G#	F#	F#	F	G	E	F#	F
D	E	D#	C#	D	D#	D	C#	C	C#	B	C	B	C	A#	A#	A	B	G#	A#	A	G	G#	A
F	F#	G	F#	F	E	F	D#	E	D#	E	D	D	C#	D#	C	D	C#	B	C	C#	C	B	A#
A#	A	G#	A	G	G#	G	G#	F#	F#	F	G	E	F#	F	D#	E	F	E	D#	D	D#	C#	D
G#	A#	A	G#	G	A	G	G#	F#	G	F	F#	F#	F	E	D	E	F	D	E	D#	D	C#	D#
F#	F	G	F	F#	E	F	D#	E	E	D#	D	C#	D	D#	C	D	C#	C	B	C#	B	C	A#
D#	E	D	D#	C#	D	D	C#	C	B	C	C#	A#	C	B	A#	A	B	A	A#	G#	A	G	G#
C#	B	C	C	B	A#	A	A#	B	G#	A#	A	G#	G	A	G	G#	F#	G	F	F#	F#	F	E
B	C	C#	C	B	A#	B	A	A#	A	A#	G#	G#	G	A	F#	G#	G	F	F#	G	F#	F	E
E	D#	D	D#	C#	D	C#	D	C	C	B	C#	A#	C	B	A	A#	B	A#	A	G#	A	G	G#
G	F	F#	F	F#	E	E	D#	F	D	E	D#	C#	D	D#	D	C#	C	C#	B	C	B	C	A#
A	A#	G#	G#	G	A	F#	G#	G	F	F#	G	F#	F	E	F	D#	E	D#	E	D	D	C#	D#
A	A#	G#	A	G	G#	G#	G	F#	F	F#	G	E	F#	F	E	D#	F	D#	E	D	D#	C#	D
G	F	F#	F#	F	E	D#	E	F	D	E	D#	D	C#	D#	C#	D	C	C#	B	C	C	B	A#
E	D#	D	C#	D	D#	C	D	C#	C	B	C#	B	C	A#	B	A	A#	A#	A	G#	G	G#	A
B	C	C#	A#	C	B	A#	A	B	A	A#	G#	A	G	G#	G#	G	F#	F	F#	G	E	F#	F

appendix eight (continued): The template used in the construction of *sixteen lines ascending* (continued).

appendix eight (continued)

D#	E	F	E	D#	D	D#	C#	D	C#	D	C	C#	C	D	C#	D#	D	D	D#	E	F	E	D#
G#	G	F#	G	F	F#	F	F#	E	E	D#	F	D#	F	E	E	F	F#	G	F#	F	G#	F#	G
B	A	A#	A	A#	G#	G#	G	A	F#	G#	G	F#	G	G#	A	G#	G	A#	G#	A	A#	B	A
C#	D	C	C	B	C#	A#	C	B	A	A#	B	B	A#	A	C	A#	B	C	C#	B	C#	C	D
C#	D	C	C#	B	C	C	B	A#	A	A#	B	A	B	A#	B	A#	C	C	C#	B	D	C	C#
B	A	A#	A#	A	G#	G	G#	A	F#	G#	G	G	F#	G#	G#	A	G	A#	G#	A	B	A#	A
G#	G	F#	F	F#	G	E	F#	F	E	D#	F	E	F	D#	F#	E	F	G	F#	F	F#	G	G#
D#	E	F	D	E	D#	D	C#	D#	C#	D	C	D	C	C#	D#	D	C#	D	D#	E	D#	F	E
F	D#	E	D#	E	D	D	C#	D#	C	D	C#	C	C#	D	D#	D	C#	E	D	D#	E	F	D#
G	G#	F#	F#	F	G	E	F#	F	D#	E	F	F	E	D#	F#	E	F	F#	G	F	G	F#	G#
A#	A	B	G#	A#	A	G	G#	A	G#	G	F#	G#	F#	G	G#	A	G	A	G#	A#	A	B	A#
C	D	C#	B	C	C#	C	B	A#	B	A	A#	A#	B	A	B	A#	C	B	C#	C	C	C#	D
D	C#	C	B	C	C#	A#	C	B	A#	A	B	A#	B	A	C	A#	B	C#	C	B	C	C#	D
A	A#	B	G#	A#	A	G#	G	A	G	G#	F#	G#	F#	G	A	G#	G	G#	A	A#	A	B	A#
F#	G#	G	F#	F	G	F	F#	E	F	D#	E	F	E	D#	E	F	F#	F	G	F#	G	F#	G#
E	D#	F	D#	E	D	D#	C#	D	D	C#	C	C	C#	D#	C#	D#	D	D#	D	E	E	F	D#

appendix eight (continued): The template used in the construction of *sixteen lines ascending* (continued).

appendix eight (continued)

F#	E	F	F#	G	F	G	F#	G#	G	A	G#	G#	A	A#	B	A#	A	C	A#	B	C	C#	B
G#	A	G	A	G#	A#	A	B	A#	A#	B	C	C#	C	B	D	C	C#	D	D#	C#	D#	D	E
B	A#	C	B	C#	C	C	C#	D	D#	D	C#	E	D	D#	E	F	D#	F	E	F#	F	G	F#
C#	D#	D	D	D#	E	F	E	D#	F#	E	F	F#	G	F	G	F#	G#	G	A	G#	G#	A	A#
D#	D	C#	D	D#	E	D#	F	E	F	E	F#	F#	G	F	G#	F#	G	A	G#	G	G#	A	A#
A#	B	C	B	C#	C	C#	C	D	D	D#	C#	E	D	D#	F	E	D#	E	F	F#	F	G	F#
G	A	G#	A	G#	A#	A#	B	A	C	A#	B	C#	C	B	C	C#	D	C#	D#	D	D#	D	E
F	E	F#	F#	G	F	G#	F#	G	A	G#	G	G#	A	A#	A	B	A#	B	A#	C	C	C#	B
F	E	F#	F	G	F#	F#	G	G#	A	G#	G	A#	G#	A	A#	B	A	B	A#	C	B	C#	C
G	A	G#	G#	A	A#	B	A#	A	C	A#	B	C	C#	B	C#	C	D	C#	D#	D	D	D#	E
A#	B	C	C#	C	B	D	C	C#	D	D#	C#	D#	D	E	D#	F	E	E	F	F#	G	F#	F
D#	D	C#	E	D	D#	E	F	D#	F	E	F#	F	G	F#	F#	G	G#	A	G#	G	A#	G#	A
C#	D#	D	D#	D	E	E	F	D#	F#	E	F	G	F#	F	F#	G	G#	G	A	G#	A	G#	A#
B	A#	C	C	C#	B	D	C	C#	D#	D	C#	D	D#	E	D#	F	E	F	E	F#	F#	G	F
G#	A	G	A#	G#	A	B	A#	A	A#	B	C	B	C#	C	C#	C	D	D	D#	C#	E	D	D#
F#	E	F	G	F#	F	F#	G	G#	G	A	G#	A	G#	A#	A#	B	A	C	A#	B	C#	C	B

appendix eight (continued): The template used in the construction of *sixteen lines ascending* (continued).

appendix nine

A	Ab	G	Ab	Gb	G	Gb	G	F	F	E	Gb	Eb	F	E	D	Eb	E	Eb	D	Db	D	C	Db
E	F	Gb	F	E	Eb	E	D	Eb	D	Eb	Db	Db	C	D	B	Db	C	Bb	B	C	B	Bb	A
Db	Eb	D	C	Db	D	Db	C	B	C	Bb	B	Bb	B	A	A	Ab	Bb	G	A	Ab	Gb	G	Ab
B	Bb	C	A	B	Bb	Ab	A	Bb	A	Ab	G	Ab	Gb	G	Gb	G	F	F	E	Gb	Eb	F	E

B	Bb	C	Bb	B	A	Bb	Ab	A	A	Ab	G	Gb	G	Ab	F	G	Gb	F	E	Gb	E	F	Eb
Db	Eb	D	Db	C	D	C	Db	B	C	Bb	B	B	Bb	A	Ab	A	Bb	G	A	Ab	G	Gb	Ab
E	F	Gb	Eb	F	E	Eb	D	E	D	Eb	Db	D	C	Db	Db	C	B	Bb	B	C	A	B	Bb
A	Ab	G	Gb	G	Ab	F	G	Gb	F	E	Gb	E	F	Eb	E	D	Eb	Eb	D	Db	C	Db	D

G	A	Ab	Gb	G	Ab	G	Gb	F	Gb	E	F	E	F	Eb	Eb	D	E	Db	Eb	D	C	Db	D
F	E	Gb	Eb	F	E	D	Eb	E	Eb	D	Db	D	C	Db	C	Db	B	B	Bb	C	A	B	Bb
D	Eb	Db	Db	C	D	B	Db	C	Bb	B	C	B	Bb	A	Bb	Ab	A	Ab	A	G	G	Gb	Ab
C	Bb	B	Bb	B	A	A	Ab	Bb	G	A	Ab	Gb	G	Ab	G	Gb	F	Gb	E	F	E	F	Eb

Bb	B	C	A	B	Bb	A	Ab	Bb	Ab	A	G	Ab	Gb	G	G	Gb	F	E	F	Gb	Eb	F	E
Eb	D	Db	C	Db	D	B	Db	C	B	Bb	C	Bb	B	A	Bb	Ab	A	A	Ab	G	Gb	G	Ab
Gb	E	F	F	E	Eb	D	Eb	E	Db	Eb	D	Db	C	D	C	Db	B	C	Bb	B	B	Bb	A
Ab	A	G	Ab	Gb	G	G	Gb	F	E	F	Gb	Eb	F	E	Eb	D	E	D	Eb	Db	D	C	Db

appendix nine: The template used in the construction of *sixteen lines descending*.

appendix nine (continued)

C	Db	B	B	Bb	C	A	B	Bb	Ab	A	Bb	Bb	A	Ab	B	A	Bb	B	C	Bb	C	B	Db
Bb	Ab	A	Ab	A	G	G	Gb	Ab	F	G	Gb	F	Gb	G	Ab	G	Gb	A	G	Ab	A	Bb	Ab
G	Gb	F	Gb	E	F	E	F	Eb	Eb	D	E	D	E	Eb	Eb	E	F	Gb	F	E	G	F	Gb
D	Eb	E	Eb	D	Db	D	C	Db	C	Db	B	C	B	Db	C	D	Db	Db	D	Eb	E	Eb	D

E	D	Eb	Eb	D	Db	C	Db	D	B	Db	C	C	B	Db	Db	D	C	Eb	Db	D	E	Eb	D
Gb	G	F	Gb	E	F	F	E	Eb	D	Eb	E	D	E	Eb	E	Eb	F	F	Gb	E	G	F	Gb
A	Ab	Bb	Ab	A	G	Ab	Gb	G	G	Gb	F	F	Gb	G	Gb	Ab	G	Ab	G	A	A	Bb	Ab
B	Db	C	B	Bb	C	Bb	B	A	Bb	Ab	A	Bb	A	Ab	A	Bb	B	Bb	C	B	C	B	Db

Db	C	B	C	Bb	B	Bb	B	A	A	Ab	Bb	Ab	Bb	A	A	Bb	B	C	B	Bb	Db	B	C
Ab	A	Bb	A	Ab	G	Ab	Gb	G	Gb	G	F	Gb	F	G	Gb	Ab	G	G	Ab	A	Bb	A	Ab
F	G	Gb	E	F	Gb	F	E	Eb	E	D	Eb	Eb	E	D	E	Eb	F	E	Gb	F	F	Gb	G
Eb	D	E	Db	Eb	D	C	Db	D	Db	C	B	Db	B	C	Db	D	C	D	Db	Eb	D	E	Eb

Eb	D	E	D	Eb	Db	D	C	Db	Db	C	B	B	C	Db	C	D	Db	D	Db	Eb	Eb	E	D
F	G	Gb	F	E	Gb	E	F	Eb	E	D	Eb	E	Eb	D	Eb	E	F	E	Gb	F	Gb	F	G
Ab	A	Bb	G	A	Ab	G	Gb	Ab	Gb	G	F	G	F	Gb	Ab	G	Gb	G	Ab	A	Ab	Bb	A
Db	C	B	Bb	B	C	A	B	Bb	A	Ab	Bb	A	Bb	Ab	B	A	Bb	C	B	Bb	B	C	Db

appendix nine (continued): The template used in the construction of sixteen lines descending (continued).

appendix nine (continued)

C	D	Db	Db	D	Eb	E	Eb	D	F	Eb	E	F	Gb	E	Gb	F	G	Gb	Ab	G	G	Ab	A
Bb	A	B	Bb	C	B	B	C	Db	D	Db	C	Eb	Db	D	Eb	E	D	E	Eb	F	E	Gb	F
G	Ab	Gb	Ab	G	A	Ab	Bb	A	A	Bb	B	C	B	Bb	Db	B	C	Db	D	C	D	Db	Eb
F	Eb	E	F	Gb	E	Gb	F	G	Gb	Ab	G	G	Ab	A	Bb	A	Ab	B	A	Bb	B	C	Bb
Eb	E	F	E	Gb	F	Gb	F	G	G	Ab	Gb	A	G	Ab	Bb	A	Ab	A	Bb	B	Bb	C	B
Ab	G	Gb	G	Ab	A	Ab	Bb	A	Bb	A	B	B	C	Bb	Db	B	C	D	Db	C	Db	D	Eb
B	A	Bb	C	B	Bb	B	C	Db	C	D	Db	D	Db	Eb	Eb	E	D	F	Eb	E	Gb	F	E
Db	D	C	Eb	Db	D	E	Eb	D	Eb	E	F	E	Gb	F	Gb	F	G	G	Ab	Gb	A	G	Ab
Db	D	C	D	Db	Eb	D	E	Eb	Eb	E	F	Gb	F	E	G	F	Gb	G	Ab	Gb	Ab	G	A
B	A	Bb	B	C	Bb	C	B	Db	C	D	Db	Db	D	Eb	E	Eb	D	F	Eb	E	F	Gb	E
Ab	G	Gb	A	G	Ab	A	Bb	Ab	Bb	A	B	Bb	C	B	B	C	Db	D	Db	C	Eb	Db	D
Eb	E	F	Gb	F	E	G	F	Gb	G	Ab	Gb	Ab	G	A	Ab	Bb	A	A	Bb	B	C	B	Bb
F	Eb	E	Gb	F	E	F	Gb	G	Gb	Ab	G	Ab	G	A	A	Bb	Ab	B	A	Bb	C	B	Bb
G	Ab	Gb	A	G	Ab	Bb	A	Ab	A	Bb	B	Bb	C	B	C	B	Db	Db	D	C	Eb	Db	D
Bb	A	B	B	C	Bb	Db	B	C	D	Db	C	Db	D	Eb	D	E	Eb	E	Eb	F	F	Gb	E
C	D	Db	D	Db	Eb	Eb	E	D	F	Eb	E	Gb	F	E	F	Gb	G	Gb	Ab	G	Ab	G	A

appendix nine (continued): The template used in the construction of *sixteen lines descending* (continued).

appendix nine (continued)

B	C	Db	C	D	Db	D	Db	Eb	Eb	E	D	F	Eb	E	Gb	F	E	F	Gb	G	Gb	Ab	G
E	Eb	D	Eb	E	F	E	Gb	F	Gb	F	G	G	Ab	Gb	A	G	Ab	Bb	A	Ab	A	Bb	B
G	F	Gb	Ab	G	Gb	G	Ab	A	Ab	Bb	A	Bb	A	B	B	C	Bb	Db	B	C	D	Db	C
A	Bb	Ab	B	A	Bb	C	B	Bb	B	C	Db	C	D	Db	D	Db	Eb	Eb	E	D	F	Eb	E

A	Bb	Ab	Bb	A	B	Bb	C	B	B	C	Db	D	Db	C	Eb	Db	D	Eb	E	D	E	Eb	F
G	F	Gb	G	Ab	Gb	Ab	G	A	Ab	Bb	A	A	Bb	B	C	B	Bb	Db	B	C	Db	D	C
E	Eb	D	F	Eb	E	F	Gb	E	Gb	F	G	Gb	Ab	G	G	Ab	A	Bb	A	Ab	B	A	Bb
B	C	Db	D	Db	C	Eb	Db	D	Eb	E	D	E	Eb	F	E	Gb	F	F	Gb	G	Ab	G	Gb

Db	B	C	D	Db	C	Db	D	Eb	D	E	Eb	E	Eb	F	F	Gb	E	G	F	Gb	Ab	G	Gb
Eb	E	D	F	Eb	E	Gb	F	E	F	Gb	G	Gb	Ab	G	Ab	G	A	A	Bb	Ab	B	A	Bb
Gb	F	G	G	Ab	Gb	A	G	Ab	Bb	A	Ab	A	Bb	B	Bb	C	B	C	B	Db	Db	D	C
Ab	Bb	A	Bb	A	B	B	C	Bb	Db	B	C	D	Db	C	Db	D	Eb	D	E	Eb	E	Eb	F

Bb	A	Ab	B	A	Bb	B	C	Bb	C	B	Db	C	D	Db	Db	D	Eb	E	Eb	D	F	Eb	E
F	Gb	G	Ab	G	Gb	A	G	Ab	A	Bb	Ab	Bb	A	B	Bb	C	B	B	C	Db	D	Db	C
D	E	Eb	Eb	E	F	Gb	F	E	G	F	Gb	G	Ab	Gb	Ab	G	A	Ab	Bb	A	A	Bb	B
C	B	Db	C	D	Db	Db	D	Eb	E	Eb	D	F	Eb	E	F	Gb	E	Gb	F	G	Gb	Ab	G

appendix nine (continued): The template used in the construction of sixteen lines descending (continued).

appendix nine (continued)

B	C	Db	C	D	Db	D	Db	Eb	Eb	E	D	F	Eb	E	Gb	F	E	F	Gb	G	Gb	Ab	G
E	Eb	D	Eb	E	F	E	Gb	F	Gb	F	G	G	Ab	Gb	A	G	Ab	Bb	A	Ab	A	Bb	B
G	F	Gb	Ab	G	Gb	G	Ab	A	Ab	Bb	A	Bb	A	B	B	C	Bb	Db	B	C	D	Db	C
A	Bb	Ab	B	A	Bb	C	B	Bb	B	C	Db	C	D	Db	D	Db	Eb	Eb	E	D	F	Eb	E
A	Bb	Ab	Bb	A	B	Bb	C	B	B	C	Db	D	Db	C	Eb	Db	D	Eb	E	D	E	Eb	F
G	F	Gb	G	Ab	Gb	Ab	G	A	Ab	Bb	A	A	Bb	B	C	B	Bb	Db	B	C	Db	D	C
E	Eb	D	F	Eb	E	F	Gb	E	Gb	F	G	Gb	Ab	G	G	Ab	A	Bb	A	Ab	B	A	Bb
B	C	Db	D	Db	C	Eb	Db	D	Eb	E	D	E	Eb	F	E	Gb	F	F	Gb	G	Ab	G	Gb
Db	B	C	D	Db	C	Db	D	Eb	D	E	Eb	E	Eb	F	F	Gb	E	G	F	Gb	Ab	G	Gb
Eb	E	D	F	Eb	E	Gb	F	E	F	Gb	G	Gb	Ab	G	Ab	G	A	A	Bb	Ab	B	A	Bb
Gb	F	G	G	Ab	Gb	A	G	Ab	Bb	A	Ab	A	Bb	B	Bb	C	B	C	B	Db	Db	D	C
Ab	Bb	A	Bb	A	B	B	C	Bb	Db	B	C	D	Db	C	Db	D	Eb	D	E	Eb	E	Eb	F
Bb	A	Ab	B	A	Bb	B	C	Bb	C	B	Db	C	D	Db	Db	D	Eb	E	Eb	D	F	Eb	E
F	Gb	G	Ab	G	Gb	A	G	Ab	A	Bb	Ab	Bb	A	B	Bb	C	B	B	C	Db	D	Db	C
D	E	Eb	Eb	E	F	Gb	F	E	G	F	Gb	G	Ab	Gb	Ab	G	A	Ab	Bb	A	A	Bb	B
C	B	Db	C	D	Db	Db	D	Eb	E	Eb	D	F	Eb	E	F	Gb	E	Gb	F	G	Gb	Ab	G

appendix nine (continued): The template used in the construction of *sixteen lines descending* (continued).

appendix nine (continued)

Ab	Gb	G	G	Gb	F	E	F	Gb	Eb	F	E	Eb	D	E	D	Eb	Db	D	C	Db	Db	C	B
Bb	B	A	Bb	Ab	A	A	Ab	G	Gb	G	Ab	F	G	Gb	F	E	Gb	E	F	Eb	E	D	Eb
Db	C	D	C	Db	B	C	Bb	B	B	Bb	A	Ab	A	Bb	G	A	Ab	G	Gb	Ab	Gb	G	F
Eb	F	E	Eb	D	E	D	Eb	Db	D	C	Db	Db	C	B	Bb	B	C	A	B	Bb	A	Ab	Bb

F	E	Eb	E	D	Eb	D	Eb	Db	Db	C	D	B	Db	C	Bb	B	C	B	Bb	A	Bb	Ab	A
C	Db	D	Db	C	B	C	Bb	B	Bb	B	A	A	Ab	Bb	G	A	Ab	Gb	G	Ab	G	Gb	F
A	B	Bb	Ab	A	Bb	A	Ab	G	Ab	Gb	G	Gb	G	F	F	E	Gb	Eb	F	E	D	Eb	E
G	Gb	Ab	F	G	Gb	E	F	Gb	F	E	Eb	E	D	Eb	D	Eb	Db	Db	C	D	B	Db	C

G	Gb	Ab	Gb	G	F	Gb	E	F	F	E	Eb	D	Eb	E	Db	Eb	D	Db	C	D	C	Db	B
A	B	Bb	A	Ab	Bb	Ab	A	G	Ab	Gb	G	G	Gb	F	E	F	Gb	Eb	F	E	Eb	D	E
C	Db	D	B	Db	C	B	Bb	C	Bb	B	A	Bb	Ab	A	A	Ab	G	Gb	G	Ab	F	G	Gb
F	E	Eb	D	Eb	E	Db	Eb	D	Db	C	D	C	Db	B	C	Bb	B	B	Bb	A	Ab	A	Bb

Eb	F	E	D	Eb	E	Eb	D	Db	D	C	Db	C	Db	B	B	Bb	C	A	B	Bb	Ab	A	Bb
Db	C	D	B	Db	C	Bb	B	C	B	Bb	A	Bb	Ab	A	Ab	A	G	G	Gb	Ab	F	G	Gb
Bb	B	A	A	Ab	Bb	G	A	Ab	Gb	G	Ab	G	Gb	F	Gb	E	F	E	F	Eb	Eb	D	E
Ab	Gb	G	Gb	G	F	F	E	Gb	Eb	F	E	D	Eb	E	Eb	D	Db	D	C	Db	C	Db	B

appendix nine (continued): The template used in the construction of sixteen lines descending (continued).